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ORIGINAL ARTICLES

Effect of Ultraviolet and Visible Rays Upon Animal Septicemia ..... A. J. Nedzel, M.D., and Ludwig Pincussen, M.D., Ph.D. 5

Therapeutic Value of Passive Hyperemia in Peripheral Vascular Disease ..... Karl Harpuder, M.D., and Irwin D. Stein, M.D. 9

Iontophoretic Medication in Ophthalmology — Theoretic and Practical Aspects ..... Gustav Erlanger, M.D. 16

Physical and Biological Aspects of Short Wave Diathermy ..... Allan Hemingway, Ph.D. 24

Fractured Hips in the Aged: Improved Prognosis Through Physical Therapy ..... Theodore Prewitt Brookes, M.D., and Frank H. Ewerhardt, M.D. 29

The Galvanic Vestibular Reaction ..... Sherman L. Shapiro, M.D. 35

Discussed by Drs. H. Brunner, Edwin J. Blonder, and Sherman L. Shapiro.

Report on Spas and Health Resorts ..... Walter S. McClellan, M.D., Chairman 42

•

EDITORIALS

Ultraviolet and Sulfanilamide in Systemic Infection 45

The Doctor in Fiction 47

•

SPECIAL SECTION

Science, News, Comments 49

•

THE STUDENT'S LIBRARY

Book Reviews 53

•

INTERNATIONAL ABSTRACTS

Abstracts from Physical Therapy, X-Ray, Radium, Biophysics 57

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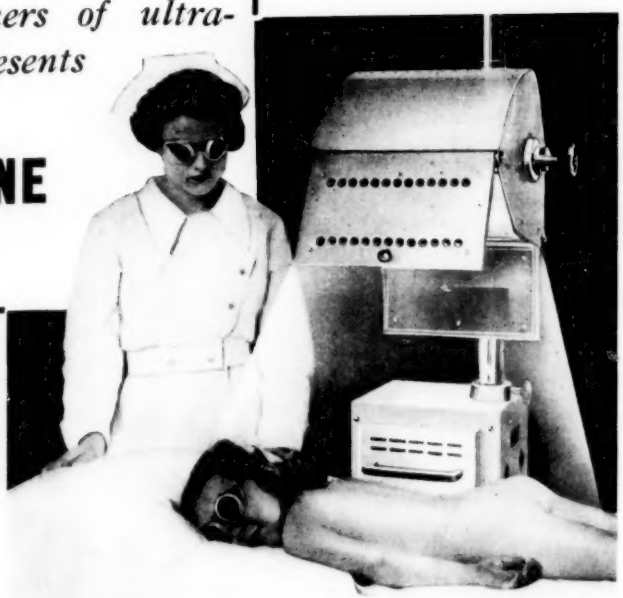

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EFFECT OF ULTRAVIOLET AND VISIBLE RAYS UPON ANIMAL SEPTICEMIA *

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and

LUDWIG PINCUSSEN, M.D., Ph.D.

CHICAGO

Collected data of the last thirty years have provided ample proof that bacteria are highly influenced by radiations, especially by those related to the ultraviolet spectrum.[1] This action only follows when microorganisms are directly exposed to the rays in vitro, or when located on the surface. Practically nothing is known about the behavior of bacteria within the irradiated organism. The shorter the wavelengths, the more are they absorbed by the superficial layers of the body. The most active rays therefore do not penetrate to the foci where most of the bacteria are located. Thus we have to assume that the effect of this form of radiation upon organisms in the body is of an indirect character. Though the wide and successful clinical application of light in surgical tuberculosis is well known, there is very little information on its effect in other bacterial infections.

So far little is known how light rays act upon bacteria in infections or how any beneficial effect is produced. We only know that irradiation raises the body temperature, which in some vague manner leads to increased phagocytic action of the white blood cells[2]. In order to clear up this problem experiments were undertaken to determine the effect of ultraviolet and visible radiation on animals infected with pathogenic bacteria, and irradiation of infected animals to whom also had been administered bactericidal drugs for purpose of studying the influence of the latter. We were especially interested to find out whether the action of certain drugs might be changed, enhanced or controlled under environmental conditions outlined above. In this connection it is interesting to note that the behavior and distribution of metals and metalloids such as silver[3], bromine and iodine in the body are greatly changed by the process of irradiation.

Our experiments were performed on white mice infected with streptococcus hemolyticus. Whereas one group was not treated with any drug, the second was given sulfanilamide mixed within the food three days before injection of streptococcus hemolyticus. Irradiation of both groups began three days prior to bacterial injections and was continued daily thereafter. Two different sources of light were used: the mercury-in-quartz with its intense ultraviolet and some visible lines, and the carbon-arc lamp with its continuous ultraviolet and visible spectrum. The "SS" sunshine carbons employed in these experiments have a luminosity similar to sunlight and a relatively high ultraviolet output. By maintaining a constant distance from the animals, practically all groups were given the same amount of light calories from the quartz and from the carbon-arc lamps; the total amounted to $\frac{200 \text{ cal.}}{\text{cm.}^2 \text{ min.}}$ To these two groups (the controls and those receiving sulfanilamide) a third one was added which received pitressin, the pressor principle of the posterior pituitary body, subcutaneously. Pitressin shows a very definite effect on the blood vessels. Its injection causes a rise in blood pressure through stimulation of the blood vessels by peripheral constriction of

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the finer arterioles and capillaries. These vascular spasms have been experimentally shown to result in anoxia of corresponding regions with deleterious effects on the tissue[4,5].

The results obtained from the above mentioned studies are presented on two accompanying charts. Figure 1 shows the data derived from the drug administered (sulfanilamide, pitressin) animals. The controls were only injected with streptococci. At the left side is registered the percentage of deaths, on the right the loss of weight of the surviving animals. With each group there is listed the fate of the controls and that of the animals irradiated with the quartz and the carbon-arc lamps.

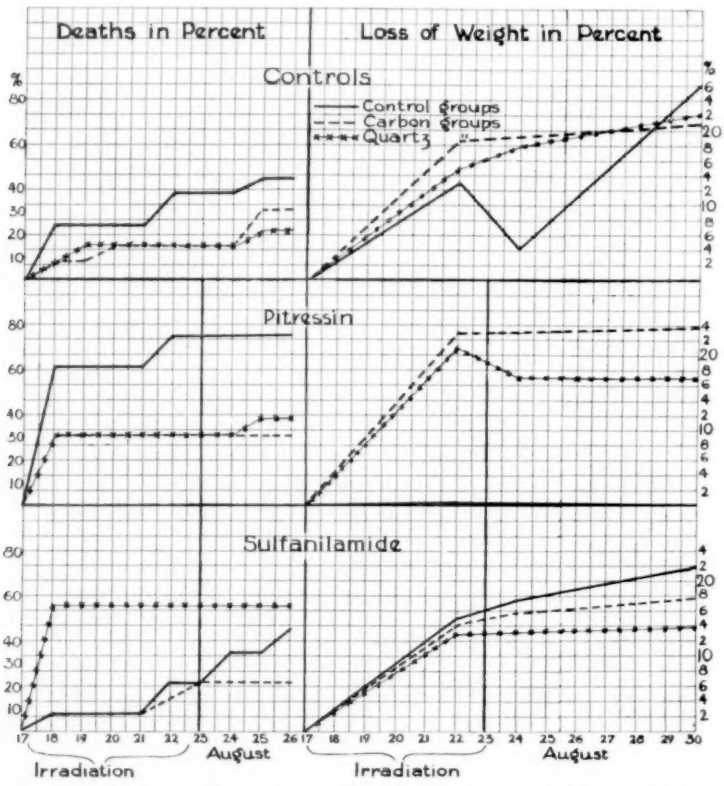

Fig. 1. — Effect of quartz and carbon-arc on non-irradiated infected animals as compared with those also treated with sulfanilamide and pitressin.

From these graphs we see that the death rate of the infected but not otherwise treated mice goes up relatively fast. In five days about 40 per cent are found dead. This mortality rate is counteracted by the effect of the radiation, so that the percentage of deaths in those irradiated with quartz and carbon-arc lamps drops to 16 per cent. In the following days the death rate goes up in all cases but less in the irradiated animals. The loss in weight of the surviving irradiated animals seems to be higher in the beginning, but later they show a better recovery. We may conclude that irradiation in these experiments has a beneficial effect.

The pitressin group clearly shows a very favorable effect following irradiation. The death rate of mice infected with streptococci is cut in half irrespective whether these were subjected to the mercury-in-quartz or carbon-arc lamp. The loss in weight seems a little greater in the carbon-arc

group. The few surviving non-irradiated animals did not show any loss of weight. The sulfanilamide group presents a very peculiar picture. Quartz lamp irradiation increased the death rate to a high degree, in contrast to the carbon-arc spectrum which did not depress the favorable sulfanilamide-effect in the first few days. In the later period, however, the death rate is only about one-half of that without irradiation.

At present we have no explanation why quartz light acts in such a fatal way, and we may have to assume for the present at least that the sulfanilamide compound circulating in the body is greatly influenced by this form of energy. It is possible that the effect of the irradiation on the body is

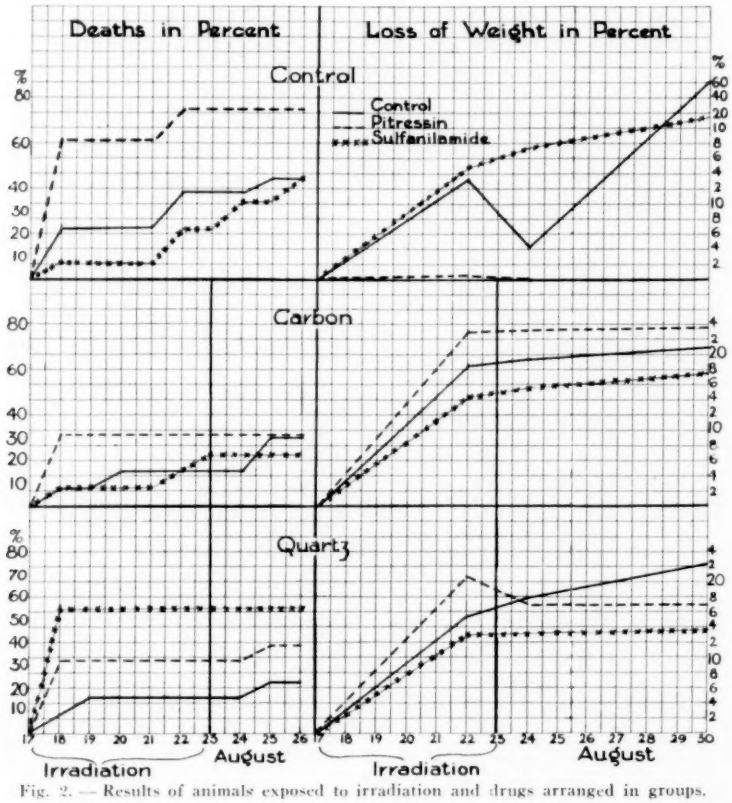

Fig. 2. — Results of animals exposed to irradiation and drugs arranged in groups.

such that it is unable to form the compound needed for the destruction of the bacteria. In the test-tube, we may recall, sulfanilamide does not act upon bacteria. The loss in weight of the surviving mice is in the end the lowest for quartz irradiated animals and the highest for the sulfanilamide animals without irradiation.

Figure 2 represents the same findings, but is rearranged in groups as exposed to irradiation. In the control group we see the highly deleterious effect of pitressin on the non-irradiated animals, whereas sulfanilamide lessens the death rate. The loss of weight does not show any special deviations. In the carbon-arc group the favorable effect of irradiation on the pitressin treated mice is very pronounced, whereas the losses in weight are the lowest for the sulfanilamide animals. In the mercury-in-quartz group, irradiation lowers the protective sulfanilamide effect as shown in the high death rate, but the losses in weight of the surviving animals are finally lower for both kinds of irradiations.

Discussion

For the present we have no rational explanation for the effect of the rays under the above method of controlled treatment. We see that some definite deviations occur when drugs and light treatment are combined, for in our experiments the death rate is higher than with drugs alone. In other cases it may be that the reverse takes place; namely, that the effect of the drug is favorably enhanced as a result of irradiation. Accordingly experiments are being continued in the hope that we shall be able to demonstrate such action of irradiations when combined with other drugs.

In experiments with pitressin we see that irradiation lowers the effect to a definite degree. There are two possibilities — either the pitressin is destroyed, at least in part, or the action or formation of an antagonist, e. i., an antagonistic hormone is increased. From clinical observation we know that the hormonal system may be influenced by rays, but this also needs to be further investigated. To date, unfortunately, scientific experiment in this field is emphasized by its paucity. Though in the nature of a preliminary survey the foregoing report is part of a research program that indicates the practical direction toward which radiation needs be explored.

There are many drugs which we think may prove extremely useful if administered simultaneously with the irradiations; for instance, the quinine derivatives and the silver compounds. From data already at hand it may be assumed that the combination of pharmacologic agents and physical therapy (in our case, light) may bring not only new knowledge on the action of light rays, but may give us (what, of course, is the most important) a new and efficient weapon against certain diseases caused by some microorganisms.

Summary and Conclusions

White mice infected with streptococci were administered the same amount of calories from a mercury-in-quartz and a carbon-arc lamp (sunshine carbons) for purpose of determining the effect of radiation alone or in combination with special drugs.

The death rates decreased from 23 per cent in non-irradiated animals to 8 per cent when irradiated with the carbon-arc lamp, and to 15 per cent in those irradiated with the quartz lamp.

When sulfanilamide was given, the death rate was higher in the irradiated animals than in the controls, increasing from 8 to 15 per cent under carbon-arc and to 54 per cent with the quartz lamp.

When infected mice were treated with pitressin, the death rate in the non-irradiated animals rose to 62 per cent, but was cut in half by irradiation either by the mercury-in-quartz or the carbon-arc lamp.

From the data observed the following conclusions may be drawn:

1. Both carbon-arc and mercury-in-quartz irradiation decrease the death rate of streptococci infected mice.

2. The mode of action on the animals seems to be twofold:

(a) Physiologic effect on the blood vessels as shown by the pitressin experiments.

(b) Chemical effect, lessening the effectiveness of the sulfanilamide compound in the body.

(*Continued on page 48*)

THERAPEUTIC VALUE OF PASSIVE HYPEREMIA IN PERIPHERAL VASCULAR DISEASE

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About forty years ago passive or venous hyperemia was introduced in modern therapy by August Bier. Since then it has been used to a moderate extent by some and considered obsolete by others. The methods of its use and its indications have varied considerably. It consists of a complete or partial, permanent or temporary obstruction of the venous blood flow and a resulting venous congestion of the treated area. It is produced by ligature of the concerned veins or by applying external pressure, e.g., with a blood pressure cuff or a rubber bandage around the extremities, or with suction cups on flat body areas. The results, will, of course, vary with the intensity and the duration of the produced circulatory changes.

Ligation of the large veins of the extremities was used mainly during the last war, when ligation of the corresponding arteries had to be carried out. Apparently the appearance of gangrene was thereby greatly diminished. Some surgeons, however, did not observe favorable results. Since the war, ligation of the venous trunks has sometimes been used in arterial embolism. Brooks[1] believes that venous obstruction results in a greater tension and a more even distribution of remaining blood sources in the distal minute vessels. The total flow of blood in a dog's extremity is less, however, after ligation of the femoral artery and the femoral vein than after occlusion of the artery alone (Montgomery[2]).

Since Bier's introduction of the method, venous constriction has been used to enhance callus formation in fractures. The clinical results are extremely difficult to evaluate. McMaster[3] performed osteotomies and bone resections bilaterally on the fibula of dogs and ligated the tibial vein on one side. Osteotomies healed four to six weeks faster on the ligated side; the results with resections, however, were not very definite. Transplantation of epithelium of the urinary bladder into the muscles of the hind legs resulted in a more rapid and more intensive ossification of the transplant on the ligated leg. Complete ligation of the great abdominal veins in dogs produced after two years degeneration and hypertrophic changes of their spines and calcification of the discs. Ligation of the femoral vein caused degenerative and proliferative alterations of the knee joint (Bernstein[4]).

Ligation of veins is not a suitable method for physical therapy. The result must depend upon the presence of collateral circulation. A marked hindrance to the flow of blood must result whenever collateral veins are absent or scant. Practically no change in circulation will occur if collateral vessels are readily available. Of greater interest to us is venous hyperemia, produced by the external pressure of a rubber cuff. Such pressure exerts an almost constant force upon superficial blood vessels. In deeper, soft tissues its force is reduced to between 90 and 70 per cent of its original value, by resistance and elasticity of the structures. The venous pressure in the extremities of the reclining, resting, healthy individual is approximately 5 - 8

mm. Hg., the arterial pressure is between 120 - 140 systolic, and 80 - 100 mm. diastolic. External pressures of between 20 - 60 mm. therefore should occlude the veins of the soft tissues without directly interfering with the arterial inflow of blood. The return of blood from an extremity, under such conditions, would take place through veins within the bones, and to a certain degree by seepage through the collapsed veins.

This form of venous hyperemia, if correctly applied, should not result in a drop of skin temperature. Skin temperature must remain at its previous level, or may be even slightly increased. Cyanosis is mild and with a reddish tinge. The volume of the extremity increases without development of marked edema. No pain of ischemia should ever appear, and pain existing previous to the use of passive hyperemia should be relieved.

Mild congestive hyperemia has been recommended for the treatment of chronic and acute non-specific inflammations, (i.e., furuncles, cellulitis, chronic osteomyelitis), chronic ulcerations of the skin, fractures, and bone and joint tuberculosis. Hyperemia is applied daily for two to twenty-two hours. Lately, passive hyperemia continuously interrrupted by intermissions at about four-minute periods has been used in peripheral vascular disease.[5]

Circulatory Effects

Our knowledge of the effects of congestive hyperemia upon the circulation and the tissues is as yet not definite. Bier's own ideas were entirely speculative. He considered the inflammation in the wake of an infection as a wholesome defense mechanism and therefore artificial hyperemia as a curative measure in local infection.

Ohmura[6] examined the effects of passive hyperemia with pressures of 20 - 80 mm. Hg. over periods of from two to ten hours. Increase of skin temperature was not observed unless there was an inflammatory condition present. With increasing pressures the skin temperatures dropped 0.5 to 2.0 C. Pitting edema is produced by pressure of 80 mm. Hg. after one to two hours; by a pressure of 40 mm. Hg. only after seven to ten hours; and by lesser pressures not at all. Simultaneously with and parallel to the appearance of pitting edema, there is an increase of the concentration of the plasma proteins and the viscosity of the blood. The albumin-globulin ratio of the plasma is altered in favor of the former. The alkali reserve of the blood is diminished by passive hyperemia. A pressure of 80-60 mm. Hg. produced a reduction of about 7 volume per cent after four hours; with 40 mm. Hg. pressure the alkali reserve dropped about 6 volume per cent only after 10 hours, and with 20 mm. even after 10 hours acidosis was but slight. Acidosis is considered a possible reason for an anti-inflammatory effect of passive hyperemia. Osborn[7] observed after passive hyperemia with the very high pressure of 100 mm. Hg. for 15-20 minutes a rise of the hemolytic complement of the serum. He assumes the development of acidosis with accumulation of CO_2, which in vitro activates the complement reaction. However, a pressure of 100 mm. Hg. must surely interfere with the arterial blood supply.

The circulatory effects of venous hyperemia have been intensively studied by Thomas Lewis[8] with the plethysmographic method. Venous occlusion with pressures of 25-30 mm. Hg. results in an increase of the volume of the limb. After release of the pressure the volume rapidly drops to its previous level. With higher pressures of 40-70 mm. Hg. the volume increases more markedly. Moreover, the drop after release is interrupted by a second rise of the volume, after which it returns to normal. This second increase for a number of reasons is believed by Lewis to be the result of an active

dilatation of the arterial circulation. He estimates in one of his experiments an arterial inflow per 100 g. tissue and per one minute of 10 ccm. under normal conditions, of 16.5 ccm. after a congestive pressure of 90 mm. Hg. for one minute, of 41.5 ccm. after five minutes pressure, and of 57.9 ccm. after ten minutes pressure. With still longer duration of the pressure the secondary volume increase is somewhat diminished.

This secondary active hyperemia in the wake of venous congestion is used by Collens and Wilensky as an explanation for the beneficial results obtained by intermittent venous occlusion at pressures of 30-160 mm. Hg. in alternating periods of three to four minutes. However, it is to be emphasized that Lewis' observation of a secondary arterial vasodilatation was made with pressures above 40 mm. Hg. only.

Schneider[9] examined the blood flow in the dog's extremities by means of a *thermostromuhr*. The extremities were severed from the trunk except for the intact femoral vessels. Occlusion of the femoral artery produced after release an intensive increase of blood flow. Occlusion of the femoral vein, however, was followed after its release by an unchanged or slightly diminished blood flow. Schneider's results, obtained with our best method for the examination of the blood flow, might cause doubt in the explanation of Lewis' observations, unless the differences in the experimental procedures are responsible for the contradictory findings.

Our own investigations have been stimulated by the introduction of intermittent venous occlusion in the treatment of peripheral vascular disease[5]. We have sometimes observed surprisingly rapid healing of old indolent ulcers under this type of therapy. We have seen no results whatever in gangrene, cellulitis and only moderately good results in rest pain. We were wondering how passive hyperemia affects the circulation in peripheral vascular disease and how important the release is both clinically and experimentally. Our observations consist of three parts: Blood chemistry as a means of gauging peripheral circulation, microscopic observations of capillary circulation, and clinical studies.

Experimental Observations

In normal individuals and in cases of peripheral vascular disease studies were made of the O_2, total CO_2 content, the O_2 capacity and the lactic acid content of the venous blood at rest, during venous compression and after its release. Compression of the veins was carried out by means of a Baumanometer at 15-40 mm. Hg. for forty minutes. In normal persons the upper extremities were used; the cuff was attached to the mid-arm and an antecubital vein punctured. In patients with peripheral vascular disease an ankle vein was punctured and the cuff applied above the knee. Skin temperatures were taken at the ball of the mid-finger and the dorsum of the big toe, respectively. Analysis of the blood was carried out according to the methods of Van Slyke and co-workers.

The skin temperatures of normal resting persons showed (with pressures of 15, 20, 30 and 40 mm. Hg.) no change or a slight drop, more marked at the end of the experiment. Mild cyanosis and some swelling of the fingers and hands appeared sometimes. After forty minutes of venous congestion, a definite but moderate diminution of the O_2 content of the venous blood is present, averaging 2-3 volume per cent. The amount of O_2 loss is not visibly related to the degree of applied pressure. One minute after complete release of pressure, the O_2 content is either identical with the values during stasis, or it approaches the previous resting values. However, there is no sign of an active hyperemia, nor increase of the O_2 content of the venous blood over preceding levels as would be expected with an

excess of blood flow. Oxygen capacities during stasis showed a very slight increase or no appreciable change. The total CO_2 content presented throughout merely insignificant and irregular variations. Lactic acid values, too, vary only little, but there is apparently a tendency to rise during mild venous compression and even more so immediately after release.

TABLE 1. — *Venous Compression in Normal Individuals*

		REST				VENOUS COMPRESSION				RELEASE			
	Pressure	O_2 Vol.%	CO_2 Vol.%	Lactic Acid mg.%	O_2 Capac. Vol.%	O_2 Vol.%	CO_2 Vol.%	Lactic Acid mg.%	O_2 Capac. Vol.%	O_2 Vol.%	CO_2 Vol.%	Lactic Acid mg.%	O_2 Capac. Vol.%
Hr.	15	17.3	56.0	16.9	21.4	15.2	56.1	17.5	21.1	17.5	54.2	22.1	21.6
Hr.	20	17.6	57.0	5.8	.....	14.3	56.6	9.8	.....	16.9	55.9	5.8	.....
Hr.	30-40	18.5	52.6	6.6	19.9	16.8	51.7	8.5	21.6	15.5	53.2	6.6	21.4
Dh.	30	16.4	51.2	12.7	20.8	13.5	52.5	9.6	21.8	16.0	50.0	16.2	21.6

The above data are easily understood as the result of diminished circulation with an increased utilization of O_2. However, under our experimental conditions, no true anoxemia appears and no appreciable accumulation of metabolites is demonstrable. A slight increase of the O_2 capacity indicates passage of fluid from the circulation into the tissues. The release of stasis is not followed by any changes in the blood chemistry corresponding to an active arterial hyperemia.

The patients with peripheral vascular disease were partly of the arteriosclerotic (with diabetes), partly of the endarteritic type. All of them were examined at 30 mm. Hg. pressure for 40 minutes. Skin temperatures remained unchanged during stasis or showed a minimal decrease. Immediately after release of the pressure, however, the skin temperature dropped in all cases between 1-4 F. Cyanosis was mild and swelling not visible or insignificant. No pain or other undue effects were observed.

In sharp contrast to the findings in normal persons, five of six patients with peripheral vascular disease showed a greater content of oxygen in the venous blood after 40 mm. of compression, than in the blood before use of passive hyperemia. Three of these five patients had advanced peripheral arteriosclerosis and diabetes, one was an advanced case of endarteritis and one a milder one. The increase in O_2 varied from 1.1 to 3.9 volume per cent and is well beyond errors of method. In one case, a man with so-called Werner's syndrome, a drop of the O_2 content amounting to 1.9 volume per cent took place, comparable to the results in healthy individuals. Simultaneously with the increase in O_2, the CO_2 content was decidedly diminished in three cases and very slightly in the others. The values of lactic acid in the blood after stasis show only minor variations compared with the preceding rest values, but certainly do not present a tendency to rise. After release of the pressure the O_2 levels vary somewhat irregularly, being slightly higher or lower than during stasis. This holds true also for CO_2 and lactic acid values. In no case do the results after release favor the presence of

TABLE 2. — *Venous Compression in Peripheral Vascular Disease*

		REST				VENOUS COMPRESSION				RELEASE			
	Pressure	O_2 Vol.%	CO_2 Vol.%	Lactic Acid mg.%	O_2 Capac. Vol.%	O_2 Vol.%	CO_2 Vol.%	Lactic Acid mg.%	O_2 Capac. Vol.%	O_2 Vol.%	CO_2 Vol.%	Lactic Acid mg.%	O_2 Capac. Vol.%
Gr.	30	11.2	53.3	16.6	20.6	9.3	52.7	13.6	20.8	12.2	51.1	14.4	21.0
Br.	30	11.9	55.0	12.2	20.9	13.2	54.0	10.0	21.9	12.8	54.8	12.8	21.5
Lg.	30	10.1	54.2	23.5	19.4	11.6	54.0	27.1	19.8	13.2	53.0	.....	20.5
Kn.	30	16.3	53.5	14.7	18.8	17.4	52.8	13.2	19.0	15.7	54.5	14.0	19.5
Fn.	30	11.0	51.3	17.1	20.0	14.9	48.4	17.1	19.9	14.2	49.2	19.1	20.4
Rn.	30	12.7	58.0	16.5	18.5	16.3	53.9	16.1	18.1	.....	.....	.....	.....

an active hyperemia. Oxygen capacities during stasis and after release of stasis are almost identical with the preceding rest values, but a tendency to a slight increase may well be assumed.

The results in the six cases of peripheral vascular disease are very difficult to explain. Increased O_2 and diminished CO_2 values point to an augmented peripheral circulation or a reduction of the metabolism of the tissues. We know nothing of metabolic changes in the tissues under the influence of an increased peripheral venous pressure. An increased peripheral blood flow could take place from the arterioles through the capillaries into the venules. Or the blood could partly take its pathways from arterioles through arterio-venous anastomoses directly into the venules. Last year we emphasized the importance of this shunt circulation in peripheral vascular disease, following the histologic work of Popoff[10] and our own chemical blood studies[11]. The above data, however, do not clearly warrant the assumption of an increased shunt circulation. In what manner venous compression is capable of producing an increased flow of blood through the capillaries and tissues is not easy to understand. The compression results (Lewis) in an elevation of the venous pressure backwards from the cuff equal to the applied active pressure. With an external pressure of 30 mm. Hg., in our own experiments the venous pressure would rise close to the value of the normal capillary blood pressure. Dilatation of the capillaries follows in the venous as well as in the arterial branch. Such dilatation is clearly visible with a capillary microscope and can easily be demonstrated in capillary photographs. However, the flow of blood in these dilated capillaries is slower than normal. Furthermore, the capillary dilatation is, in our experience, much the same in normal persons and in cases of peripheral vascular disease. The former show a diminution of O_2 and the latter an elevation during stasis. Studies with the capillary microscope revealed many anomalies in the capillary architecture in cases of peripheral vascular disease, such as local stasis, bridging of capillary loops, irregular branching off of loops, irregular and wild arrangement of loops, widely open venous sinuses and sometimes true arterio-venous anastomoses. The number of open capillaries appeared in some cases normal and sometimes scant. However, it has been possible to demonstrate an increase in the number of patent capillaries under the influence of venous compression. An increased number of capillary bridges and true anastomoses is not visible. All the visible minute blood vessels dilate, are thickly filled with blood, and present a slow flow of blood. Observation of skin capillaries is, of course, open to criticism, because the superficial skin veins and the skin circulation are directly and more exposed to the influence of venous occlusion than the deeper circulation.

Whatever mechanism may be responsible for the above results, the following statements seem justified: Under the influence of mild venous compression of 40 minutes' duration the venous blood of normal persons carries less and the venous blood of cases with peripheral vascular disease (with one exception in six experiments) carries more O_2 than under normal conditions. Signs of an increasing O_2 debt in the tissues — elevation of lactic acid values — are very slight in normals, and entirely missing in the cases of peripheral vascular disease. The combination of a higher O_2 content, an unchanged lactic acid level in the venous blood and a slower circulation which should allow a better utilization of the blood O_2 by the tissues — suggests the assumption that venous compression improves the nutrition of tissues in cases of peripheral vascular disease. After release of the compression with 15-40 mm. Hg. in normals and 30 mm. Hg. in peripheral vascular disease, neither the O_2 and CO_2 values nor the skin temperatures point to the appearance of an active hyperemia.

Clinical Observations

Simultaneously with the above investigations we studied the therapeutic value of passive hyperemia in cases of peripheral vascular disease. Venous compression was carried out by a rubber bandage, 4 inches in width, applied with very little pressure above the knee, daily, for increasing periods of two to eight hours. With the bandage correctly applied, even after eight hours, cyanosis is rather slight and of a reddish tinge; the limb appears little swelled, but with no or only traces of pitting edema; the skin temperature differs little in both directions from that of the other leg. There is no pain whatever caused by this type of venous congestion.

The number of cases observed so far is small, and we are fully aware of the difficulties in evaluating clinical results in chronic diseases with spontaneous variations of their courses. We have seen neither favorable nor undue effects in several cases of dry gangrene of arteriosclerotic diabetes. There have been no results obtained in several cases of endarteritis with a complicating chronic or subacute cellulitis. Patients with peripheral arteriosclerosis of endarteritis suffering from pain at rest, sometimes reported relief of pain, but as a whole, venous congestion did not seem to be of great help to them.

Favorable results, however, are apparently obtained in peripheral vascular disease of either type with indolent ulcerations. We treated 9 such cases during the last few months. Two did not respond. One is a male, 38 years of age, with endarteritis obliterans, a large ulceration on the dorsum of the right foot, edema and chronic cellulitis The other is a woman, aged 65, who had arteriosclerosis and diabetes, right hemiplegia, with a small, crust-covered ulcer on the right heel and marked rest pain. Neither the pain nor the ulcer has improved.

In the remaining 7 cases passive hyperemia apparently had a beneficial influence upon the ulceration.

Case Reports

CASE 1. — A male, 51 years, had endarteritis since 12 years ago, and developed an ulceration of about 2 cm. in diameter on the left leg between the lower and middle third. Unsuccessfully treated for three months by other means, the ulcer healed completely within two months under passive hyperemia applied daily. This patient had no oscillometric readings on his left ankle and calf, histamine reaction was entirely negative on the dorsum of the left foot, and a very slight flare appeared on his ankle, calf and thigh. Right mid-thigh amputation, because of gangrene was performed in 1933.

CASE 2. — A male, 54, had endarteritis for 18 years. All toes on both feet have become gangrenous in these years with spontaneous amputations. A large ulceration about 12 x 25 cm. at the base of the left foot with rest pain was unsuccessfully treated for seven months. When passive hyperemia was applied, rapid granulation and epithelization set in and the size of the ulcer diminished within two months to about 1 x ½ cm. It took two more months before the ulcer was completely healed. Oscillometric readings of both ankles: ¼-½, left calf 2, right calf 4. Histamine tests of both feet were faint; but fair in both calfs and thighs. Landis-Gibbon test: no response. Skin temperature on base of right foot 76 F. at 74 room temperature.

CASE 3. — A male, 40 years, with known endarteritis for 10 years. Has lost all toes of right foot. Ulcerations on the base of the right foot and on the left toes since 1934, with periodical healing and recurrences. Last recurrence appeared one year ago with deep ulcerations around the stump of the right big toe and that of the right second toe, over the tip of the left great toe and the plantar side of the left little toe. The ulcers of the left foot healed after seven weeks' application of passive hyperemia. The ulcer on the right foot was reduced to the size of a pea at that time, and completely healed after an additional month of treatment. Histamine reactions: right foot, negative; left foot, good flare, slight wheal; right calf, fair; left calf, normal. Oscillometric readings negative at both ankles.

CASE 4. — A male, 47 years, had endarteritis for 13 years. Right mid-thigh amputation was performed ten years ago. Seven years ago ulcers developed on the

left toes, with periodical healing and recurrences resulting in their fusion. Shallow, infected ulceration covered the entire base of left foot since six weeks. While treated with passive hyperemia for one month, the ulcer was reduced to about the size of a nickel. Aristol powder was then applied for one day with a resulting cellulitis, blister formation and a new breakdown of the skin. An ulcer developed covering about two-thirds of the base of the foot. With the subsiding of the acute inflammation, hyperemia treatment was resumed ten days later. One month of treatment again reduced the size of the ulcer to two areas of about 1 cm. diameter. This patient had negative oscillometric readings on his left ankle, and low excursions on his left calf and thigh. Histamine reactions were faint on both ankles and calves, and moderate on the thighs.

Case 5. — A female, 62 years, a diabetic for five years, developed gangrene of the left foot nine months ago. Mid-thigh amputation was performed, eight months ago. The stump still showed a large ulcer, 10 x 12 cm. on the top, and a second ulcer of 2 x 3 cm. on its lateral aspect. Passive hyperemia was applied and both ulcers were completely healed after eleven weeks. The patient had patent femoral and right popliteal arteries and no pulsation on her remaining right foot.

Case 6. — A male, 55 years with diabetes for 16 years, had symptoms of peripheral vascular disease for four years, and developed gangrene four months ago on the left foot. Three and one-half months ago he had a mid-leg amputation. The stump formed a large infected ulceration of 5 x 7.5 cm. covered with necrotic tissue and without any granulation. After one month's application of passive hyperemia the ulceration was reduced to two small areas, of 1 and 1½ cm. diameter, respectively, granulating, and with spreading epithelization. This patient had low oscillometric readings on his left calf and thigh and the entire right lower extremity. Histamine reactions were negative on both calves and the right ankle, and fair on both thighs.

Case 7. — A male, 40 years, with so-called Werner's syndrome, had an ulcer of long standing on his right big toe and the right first metatarsal bone, which exposed the bones. Six weeks after resection of the metatarsal bone and the big toe there still was no tendency to heal. He suffered from marked pain. With application of passive hyperemia the pain disappeared immediately and the ulcer was reduced to the size of a pea within ten weeks.

In two other cases with ulcerations the application of Bier's hyperemia did not result in a definite improvement. Intermittent venous occlusion (with a pressure of 35-40 mm. Hg. for periods of two minutes) brought about the healing of the ulcers within four to six weeks of daily treatment of eight hours' duration.

All the above patients had routine care at the department, consisting of dressings with desitin ointment and ultraviolet radiation. This routine care has been carried out for many years on similar cases with unsatisfactory results. However, we have obtained fair results by a combination with histamine iontophoresis or other measures to improve the peripheral circulation. The results gained by intermittent venous occlusion and by simple passive hyperemia are apparently in our experience more satisfactory than those accomplished before. We do not believe that passive hyperemia in any form is capable of performing miracles in peripheral vascular disease. We believe it is a valuable aid in treating ulcerations in cases of peripheral vascular disease.

Conclusions

1. Experimental evidence suggests that venous hyperemia improves the nutrition of the tissues.

2. Experimental investigation shows the absence of active hyperemia after release of venous compression with pressures below 40 mm. Hg.

3. Clinical observations demonstrate the therapeutic value of passive hyperemia in ulcers in peripheral vascular disease.

4. Simple venous compression is in many cases not inferior to intermittent venous compression.

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(*Continued on page 60*)

IONTOPHORETIC MEDICATION IN OPHTHALMOLOGY *

Theoretic and Practical Aspects

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NEW YORK

The introduction of drugs into living tissues by weak galvanic currents promises to play an important role in modern therapy because of proof that iontophoretic medication within physiologic limits often attains pharmacodynamic effects and therapeutic results superior to methods in common practice. If the increasing literature on iontophoresis may be taken as an index of the interest manifested, the varied and impressive contributions are proof of the progress in this field. In publications of recent date several authors review the action, indications and benefits of electrophoresis of drugs in rheumatic and otolaryngologic conditions. Both Kovács[1] and Hollender[2] recommend the method as the one that holds out promise. Referring to the same method for the treatment of peripheral vascular disease, Joseph Kovács[3] has frequently pointed out the safety and superiority of mecholyl-iontophoresis as compared to other drugs.

The foregoing reference to the literature shows that iontophoretic medication is already well known and widespread in use. In ophthalmology iontophoresis was originally practiced by only a few. Wirtz[4] and Schnyder[5] report many satisfactory results from ionization. Bos[6] provided experimental proof of the different effects of drugs in the electric field on the eyes of rabbits as compared with the effects of the same drugs used in the conventional manner. Brecher[7] recognizes the almost unlimited possibilities of this procedure, and is confident that this method soon will attain a prominent place as a therapeutic method. Numerous publications about iontophoretic medication in ophthalmology prove to a great extent that this special method differs in the effect obtained by the usual application of drugs. The reported favorable and sometimes excellent therapeutic results clearly indicate that observers in the past were more interested in the clinical findings than in the analysis of the fundamental action of the electrically propelled drug on the tissues. For this reason experimental investigations were performed on different animals which brought forth data of special interest to the profession.

As a result of long observation I[3] have reached the conclusion that iontophoresis does not only produce a local action on the tissue but the whole metabolism of the eye is suddenly changed. The intraocular tension of the eye is in the first place often increased, this to a large extent depending upon the drug, and in its secondary phases sometimes decreased. Under experimentation the tension might rise to about 50 mm. Hg. and then fall to 5 to 8 mm. Hg. So far as the circulation is concerned it becomes more active with such a sudden variation of intraocular tension.

Experimental Observations

Study of the influence of certain drugs upon the autonomic nervous system offers an explanation of the general effects of iontophoretic medication. A series of experiments with the stimulants and antagonists of the parasympathetic and the stimulants of the sympathetic nervous system reveal the deep-reaching effects of iontophoresis. At the International Congress of Radiology, Chicago, and at the American Congress of Physical Therapy,

* In collaboration with Heinrich F. Wolf, at the Manhattan General Hospital, New York.

Cincinnati, 1937, I reported that under the influence of the galvanic current certain drugs (atropine, acetylcholine, prostigmine, adrenaline) have a special action on the autonomic nervous system developing under favorable conditions characteristics which we may call electro-motor or electro-kinetic effects.

These effects consist of:

1. Miosis which always sets in after iontophoresis, and is the expression of a temporary reaction of the parasympathetic nervous system.
2. Prolonged duration of the specific action of the drug.
3. Changed balance between the parasympathetic nervous system and the sympathetic nervous system. It may occur that one of the two systems is blocked, with the result that the antagonist becomes ineffective even when introduced by iontophoresis.

In further experimentations* I studied the action of various drugs and combinations of drugs on the autonomic nervous system. On the basis of former findings the drugs were introduced with a strength of the current between 2 and 3 milliamperes and care was taken not to exceed the time beyond three minutes.

A 1 per cent solution of acetylcholine was introduced from the anode into the eye of a rabbit at 2.2 milliamperes for three minutes. An immediate miosis was produced. Five minutes later adrenaline (1:1000) was introduced from the anode at 2.1 milliamperes for three minutes. Ten minutes later the pupil began to dilate and reached half an hour later a width of 8 mm. (fig. 1).

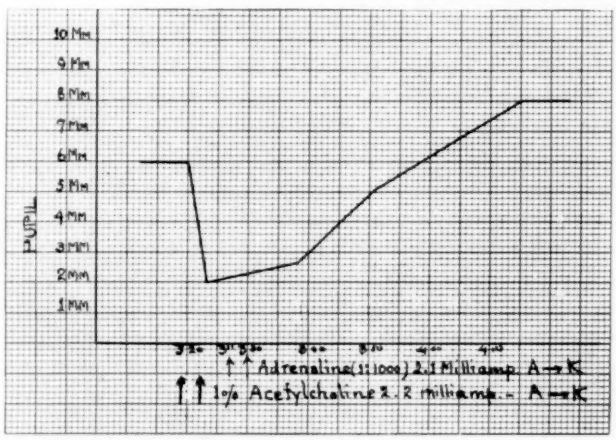

Fig. 1

Adrenaline (1:1000) was introduced from the anode at 2 milliamperes for one minute. The pupil became a miotic to 3 mm. and two minutes later adrenaline (1:1000) was again introduced for two minutes at the same intensity of current. Mydriasis developed within five minutes. The pupil attained a width of 9 mm. Now 0.1 cc., of a 1 per cent solution of acetylcholine was injected subconjunctivally. The curve went down somewhat, but only the iontophoretic introduction of a 1 per cent solution of acetylcholine at 2.2 milliamperes for two minutes produced a miosis of 3 mm., for a period of about forty minutes.

In a control test mydriasis was produced by adrenaline-iontophoresis. When the pupil was 8 mm. wide, sodium chloride was applied from the positive pole at 2.1 milliamperes for three minutes. The pupil did not react in

* The experiments were performed in the Laboratory of the Manhattan General Hospital to which I am much indebted.

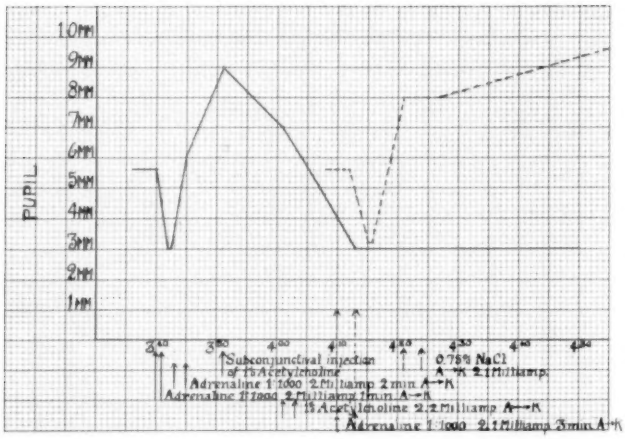

Fig. 2

the sense of a miosis, and the further development of a mydriasis was not checked (fig. 2).

The experiments show that under certain circumstances adrenaline overcomes the effect of acetylcholine, and acetylcholine prevents the effect of adrenaline. The curve suggests further that the subconjunctival injection of acetylcholine is not as effective as the iontophoretic introduction of the same drug. Sodium when introduced by iontophoresis has no effect upon the adrenaline pupil.

The iontophoretic introduction of combinations of adrenaline and acetylcholine demonstrates the predominance of adrenaline. This is valid for a combination of adrenaline 1:1000 and acetylcholine 1:20, and for a combination of adrenaline 1:2000 and acetylcholine 1:100. After miosis of short duration the pupil becomes wide again (fig. 3).

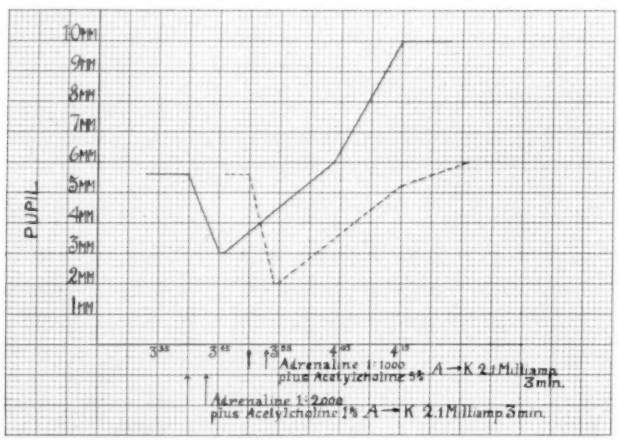

Fig. 3

After many experiments it became obvious that a combination of adrenaline 1:5000 and acetylcholine 1:100 at 2.1 milliamperes for three minutes introduced from the anode, restored the original width of 6 mm. of the pupil. When the pupil had become 6 mm. wide, a 2.5 per cent solution of fluorescein (2 cc.) was injected intravenously. The fluorescein appeared

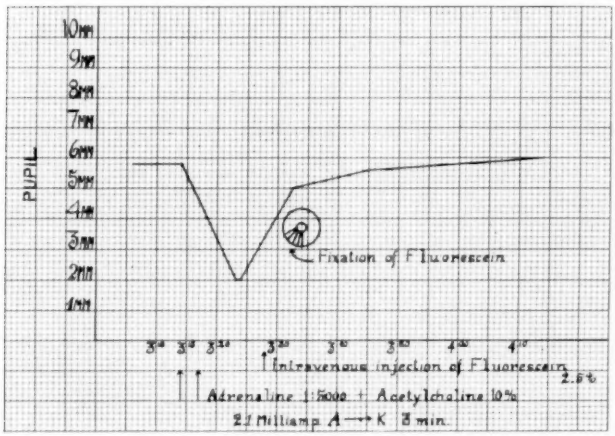

Fig. 4

shortly after the injection only in the lower sector of the iris (as indicated by the shading in the ring), while the upper, lateral and medial sectors were free from the stain (fig. 4). The conclusion is permissible that acetylcholine and adrenaline are attached to different parts of the iris. This observation, therefore, possibly illustrates the distribution of drugs under the influence of the galvanic current.

The introduction of adrenaline (1:1000) at 2.5 milliamperes for three minutes produced miosis and then a dilation of the pupil to 8½ mm. At the height of the mydriasis 2 cc. of a 2.5 per cent solution of fluorescein was injected intravenously. The stain did not emerge from behind the pupil, but formed a green ring at the margin of the pupil (fig. 5).

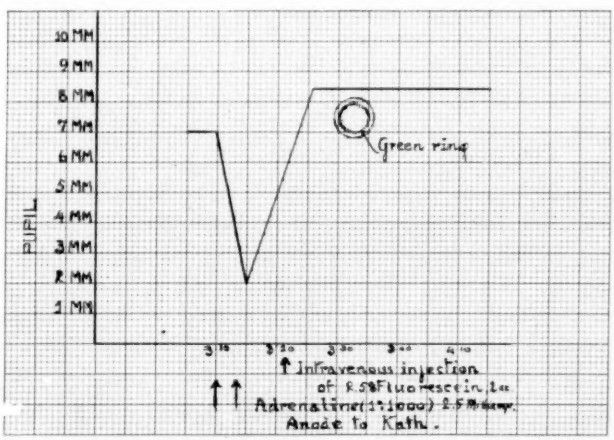

Fig. 5

The instillation of one drug of a 1 per cent solution of atropine dilates the pupils to 9 mm. after 25 minutes. At the height of the dilation a 1 per cent solution of acetylcholine was introduced from the anode at 2.1 milliamperes for three minutes. The pupil contracted to 3 mm. after ten minutes, and the atropine effect was entirely overcome. Fluorescein was injected intravenously immediately after the iontophoresis of acetylcholine. The stain did not appear in the anterior chamber because of the still existing effect of

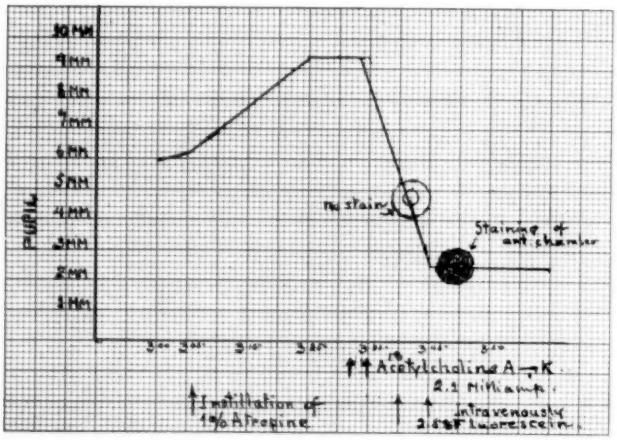

Fig. 6

the atropine, contrary to my observation that the stain appears in the anterior chamber promptly after any acetylcholine iontophoresis. But as soon as the miosis sets in and a second injection of fluorescein is administered, the stain pours out from all parts of the iris, and from behind the iris. Some minutes later the anterior chamber becomes green (fig. 6).

The fact that mydriasis after atropine, as described above, is overcome by acetylcholine is one of the best proofs of the efficacy of iontophoretic medication. By no other means can a mydriatic pupil be overcome. If we accept the physiologic theory (Wright[9]) that the atropine effect prevents the access of acetylcholine to the cells of the iris, this experiment shows that this explanation may not hold good under all conditions.

Prostigmine, another member of the group of stimulants of the parasympathetic nervous system, introduced from the anode at 2.5 milliamperes for three minutes in dilutions from 1:2000 to 1:100000 also produced prolonged miosis. The higher the dilution, the longer is the latent period, i.e., the miosis sets in much later (fig. 7).

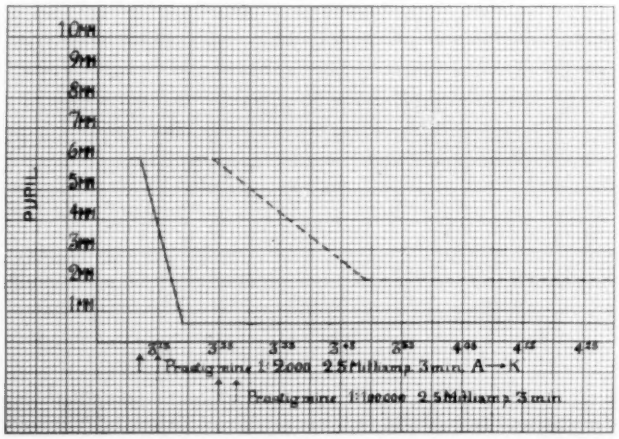

Fig. 7

Histamine in dilution of 1:5000 introduced from the anode, first produced miosis, and then a normal width of the pupil. In dilutions of 1:1000 it produced a slight mydriasis (fig. 8).

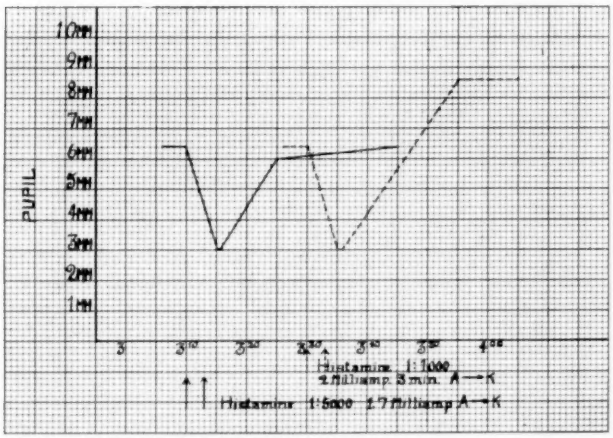

Fig. 8

These experiments furnish a clear picture of the possibilities of iontophoretic medication. The conclusion may be drawn that the autonomic nervous system is strongly affected by the administration of a drug by means of the galvanic current. It appears that this procedure enables us to alter the balance of the autonomic nervous system of the eye. The miosis which can be observed is important as the expression of a reaction of the tissues themselves due to the release of acetylcholine, the stimulant of the parasympathetic nervous system. Engelhart[10] stimulated the oculomotor nerve of the eyes of cats and rabbits by faradic impulses and proved that after this stimulation the amount of the "Vagusstoff" (acetylcholine) was considerably increased. The long specific effect of the drugs is to be attributed to the prolonged fixation of the drugs to the cells. This is the most significant factor and explains, together with the influence upon the autonomic nervous system, the pharmacodynamics of iontophoresis.

Clinical Observations

So far as the practical aspects of iontophoretic medication are concerned, I should like to speak briefly about the treatment of the more common diseases of the eye. I wish to refer to papers by Edison,[11] and Nuemi.[12] These authors report good results in the treatment of trachoma. Edison applies zinc-iontophoresis with a special electrode. Nuemi recommends a 25 per cent solution of calcium chloride. Both stress the effect on the deeper layers of the conjunctiva.

According to my observations of many years, diseases of the cornea respond frequently to iontophoretic medication. I generally use combinations of zinc and adrenaline (zinc sulfate 1:400 and two or three drops of adrenaline 1:1000), calcium chloride (1:300) and adrenaline, or quinine hydrochloride (1:500). Zinc is effective as a disinfectant, adrenaline regulates the altered balance of the autonomic nervous system, calcium has a similar effect and increases in combination with adrenaline the effect of adrenaline, as its synergist. Quinine acts as a mild disinfectant and has a stimulating action on the changed epithelium.

In acute infections of the cornea I begin with zinc-adrenaline iontophoresis, two to three treatments, and after these treatments I apply calcium and adrenaline. In chronic cases calcium-adrenaline iontophoresis is more effective. Quinine iontophoresis can be applied in cases of herpetic origin. All of these methods do not interfere with the usual treatment by ointments or drops or any specific treatment which may be indicated.

A large number of publications enthusiastically report on the therapeutic effects of iontophoretic medication. For instance, Itoh[13] reports 2417 cases treated during a period of ten years. Le Cam,[14] in his thesis, comes to the conclusion that iontophoretic medication finds one of its best indications in the corneal affections. His results have been excellent. Even neglected cases reacted most favorably. Iontophoretic medication of diseases of the cornea has a value as a preventive because the final results, due to the thorough absorption of infiltrations, are highly satisfactory. The earlier the treatment is applied, the better are the results.

According to Rochat,[15] cases of iritis are benefited by iontophoresis with atropine (1:1000). I have observed that adrenaline (1:2000 to 1:10000) iontophoresis or a mixture of calcium chloride (1:300) with two or three drops of adrenaline prepares the iris for a stronger action of the subsequent atropine instillation. The electrode is placed on the cornea. Only when there is a more localized inflammation is the electrode applied to the region of the inflammation.

Karbowski[16] confirms the deep and long effect of iontophoresis. He had good results with adrenaline in the treatment of secondary glaucoma and of chronic glaucoma. He maintains that adrenaline iontophoresis produces anemia of the choroid.

The physiologic and therapeutic effects of iontophoresis with drugs (adrenaline, acetylcholine, doryl, prostigmine, mecholyl) were studied in a long series of cases involving eyes with congenital amblyopia, changes and diseases of the choroid, retina and the optic nerve. According to the experiments with these substances it could be expected that iontophoresis would exert considerable influence upon these tissues. There exists also an experimental proof of the deep penetration of ions to the vitreous, for instance of iodine and zinc, for a duration of more than twelve hours (Watanabe[17]).

Considering that even small doses of eserine inactivate the esterases in the tissues and increase the effect of acetylcholine, I took advantage of iontophoresis with eserine and acetylcholine in treating the deeper layers of the eye. The technic of this procedure consists of the application of a solution of eserine salicylate (1:30000) by a special electrode to the whole eyeball for a period of ten to twenty minutes at 1½ to 2 milliamperes, and subsequent iontophoresis with acetylcholine (1:200). Acetylcholine is applied by means of a metal applicator (which is topped with cotton saturated with the solution) to four different sectors of the eye, as far away from the limbus as possible. Each sector is treated for one minute at 1 milliampere. This treatment exerts a long effect upon the entire vascular system of the eye, in the sense of dilatation of the vessels, quick absorption of exudates and improvement of circulation.

It is interesting to note the effect on the retina and to see how an amblyopic eye which shows no pathologic process, often reacts immediately to such treatment with improved vision both far and near. In some cases after a series of 10 to 20 treatments, vision is sufficiently improved so that muscle exercises can follow with success. Central scotomas which often complicate cases of amblyopic eyes disappear early. The assumption is that this treatment releases substances in the retina which it needs for proper function.

In all my cases of choroiditis, of retinitis of different origins, improvement of vision to a lesser or greater extent may be attributed to iontophoretic medication.

Kaz[18] treated 28 cases of uveitis, 16 cases of maculitis and 26 cases of inflammation of the optic nerve with calcium iontophoresis. He is of the opinion that visual improvement is due to this method. Good results were obtained also by Bielski[19] in diseases of the choroid of myopic origin.

Though I admit that calcium iontophoresis is effective in these cases, probably by the release of acetylcholine in the tissues of the eye, I prefer inundation of the tissues of the eye with acetylcholine. This treatment may be compared to mecholyl iontophoresis of peripheral vascular diseases with its good therapeutic results.

The effect of iontophoretic medication with eserine-acetylcholine is best illustrated by the favorable reaction of the retrobulbar affections of the optic nerve, be they due to multiple sclerosis or changes in the nasal sinuses. The extreme sensitivity of the papillomacular bundle of the optic nerve to infections and toxic influences is characterized by the appearance of a central scotoma for colors. This sensitive bundle likewise responds to adequate treatment. In many such cases the central scotoma disappears partly after the first treatment, and then completely. This does not only apply to acute cases but also to those of long duration that have proved refractory to other treatments.

Summary and Conclusions

Iontophoretic treatment of diseases of different parts of the body and especially of the eye, directs attention to a thorough study of the changes in the tissues of the body and of the eye.

Experimental studies in connection with iontophoretic medication stress the particular involvement of the autonomic nervous system. These studies lead to new viewpoints of the physiology of the eye and the pharmacodynamics of drugs.

Intophoretic medication is of value in the treatment of the anterior parts of the eye, and often is preventive because of the thorough absorption of infiltrations in corneal diseases. Treatment of the posterior parts of the eye has become effective since the iontophoretic application of acetylcholine and similar drugs has been initiated.

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PHYSICAL AND BIOLOGICAL ASPECTS OF SHORT WAVE DIATHERMY *

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It is the purpose of this paper to point out the outstanding experimental findings of recent work which have physical, chemical and physiological significance for medicine. A short wave diathermy apparatus produces alternating current whose frequency lies within a range of 10 to 100 megacycles (one million cycles) per second. Such a machine will also generate radiant energy. The radiant energy transmitted has a frequency equal to that of the alternating current generated. In place of using the term frequency to designate the type of radiation produced the term wavelength can be used. The radiation from the machine travels with the velocity of light of 300 million meters per second.

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Since the frequency is the number of waves of radiant energy generated per second, the wavelength is the velocity divided by the frequency. The wavelengths and their corresponding frequencies are shown in the following table:

TABLE 1. — *Frequencies and Corresponding Wavelength*

frequency megacycles per second	wavelengths meters	
1	300	long wave diathermy
10	30	short wave diathermy
15	20	
30	10	
60	5	
100	3	

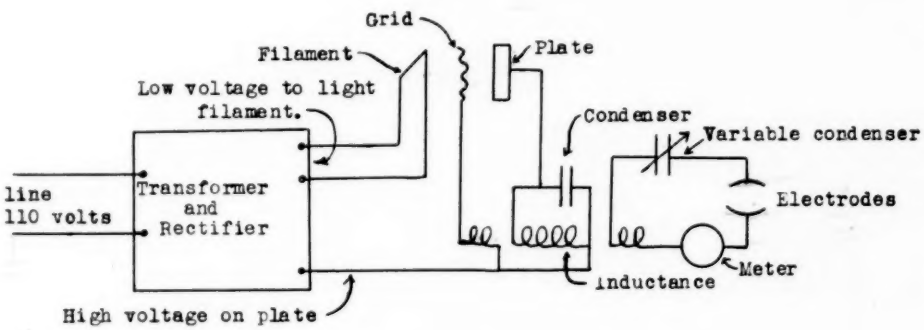

Fig. 1. — Schematic diagram of a vacuum tube oscillator.

A short wave generator converts the ordinary low frequency line current into a very high frequency current, virtually all generators contain a vacuum tube oscillating circuit of which a simple diagram is shown.

The line voltage is fed into the primary of a transformer. From the secondary coils of the transformer a low voltage is applied to the filament which is heated to incandescence, and a high voltage is applied to the plate of a vacuum tube. In some machines the high voltage is rectified or converted into a direct current voltage. The frequency of the alternating current generated by this oscillating circuit depends upon (1) the area and number of plates of the condenser which determine the capacity, and (2) the diameter and number of turns of the coil which fix the inductance. The smaller the inductance and the capacity, the higher will be the frequency of the generated current. The electrodes between which the patient is placed are part of a receiving circuit containing a condenser (capacity), a coil (inductance) and a meter. The current which passes through the meter and the patient is adjusted by varying the capacity of the condenser. We shall next consider the process whereby the electrical energy of the machine becomes transformed into heat energy within the tissue.

Conversion of Electrical Energy Into Heat Energy

There are two possible explanations for the heat production within tissue placed between the electrodes of a short wave diathermy machine. One explanation first given by Pätzold[1] and later verified by McClennan and Burton[2] is to consider the electrodes, the space between the electrodes and the tissue, and the various tissues themselves as component parts of the receiving circuit. The tissues and air space comprise a system of condensers and conductors which are heated in accordance with the known physical laws of alternating currents. This may be called the "conduction" theory. The other possible explanation may be termed the "electrical field" theory and has been proposed by McClennan and

Burton.[2] In this theory a conducting system, such as a tissue in the rapidly alternating field, has generated within it alternating currents whose value depends on the field strength, conduction and dielectric properties of the tissue. The difference between these two explanations depends on whether we consider the tissue between the electrodes to be heated by the conduction current of the receiving circuit or to receive energy from a high frequency field. Both of these explanations find their expression in the form of the rather complicated mathematics of the electromagnetic theory, and both lead to the same conclusions. The least complex of these two explanations is the conduction theory, and since this is more applicable to both forms of diathermy, it is the one of choice. A brief description of this theory will now be given.

An ideal condenser consists of two good conductors of electricity separated by a poor conductor called a dielectric. A dielectric which has a very low electrical conductivity is air. A condenser consisting of two metallic plates separated by an air space offers impedance to the flow of an alternating current. This impedance depends upon the frequency of the current and becomes lowered when the frequency of the alternating current is raised. Increasing the frequency of an alternating current from one to one hundred million cycles per second will reduce the impedance of an air condenser to one per cent. Table 2 shows how by increasing the frequency the flow of more current is permitted across the air condenser owing to a reduction of its impedance:

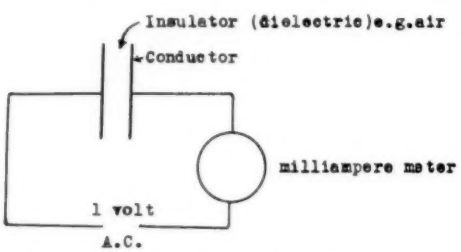

Fig. 2. — Condenser in an alternating current circuit.

TABLE 2. — *Proportionate Increase of Frequency and Amperage*

frequency (million cycles)	current milliamperes	
1	10	diathermy
10	100	short wave diathermy
100	1000	short wave diathermy

In the application of short wave diathermy the tissues to be heated are situated between insulated electrodes as shown in the following diagram:

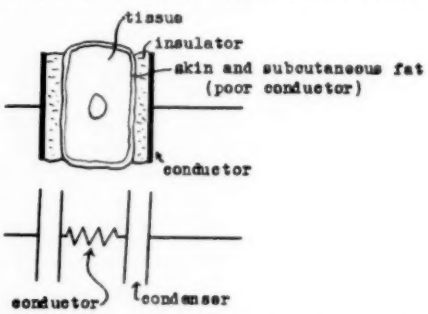

Fig. 3. — Diagram illustrating how insulator between skin and electrode behaves as a dielectric of a condenser.

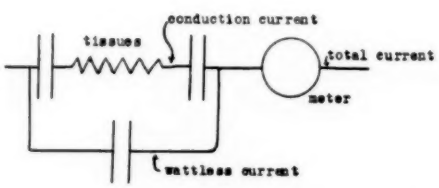

Fig. 4. — Electrical equivalent of tissue heated by diathermy.

The electrodes, tissue and insulators form two condensers in series. The insulator between the tissue and the electrode is the dielectric of each condenser.

The greatly increased frequency of the short wave diathermy machine makes it possible to use a thick insulator or air between the electrodes and the skin. The impedance of this condenser would be sufficiently high to block a low frequency current of one million cycles but becomes greatly reduced when the frequency is increased. This explains why it is necessary to use contact electrodes with diathermy, while insulated electrodes may be used in short wave diathermy.

There is a further complication in this scheme. The two metallic electrodes themselves behave as the plates of a condenser. A flow of current can occur across this condenser which does not pass through the tissues. This condenser acts as a by-pass and shunts some of the current away from the tissue. The entire scheme can be most simply represented as follows:

The total current which is registered on the meter consists of two components; namely, (1) a heating current which passes through the tissues and (2) a wattless component which does not heat the tissues but passes across the electrodes as through a condenser. With this brief description of the behavior of short wave diathermy currents we may now discuss the advantages and disadvantages of this form of therapy from a physical point of view.

Advantages and Disadvantages of Short Wave Diathermy

Regulation of Dosage. — As already mentioned the ammeter of the short wave diathermy machine indicates the total current of the circuit. Part of this current is wattless and does not produce heat. It is not possible to determine the magnitude of this wattless component nor the amount of the true heating current. These two components depend on the shape, size and position of the electrodes as well as the position, composition and shape of the part of the body heated. The wattless component is therefore practically never the same for two treatments unless the conditions are exactly identical. There is one use for the high frequency ammeter. The true heating current is always less than the meter reading. Due to this uncertainty of the meter reading more reliance must be placed on the tolerance of the patient and his sensation of warmth. In determining dosages for this form of therapy, especially high dosages, considerable precaution should be taken since the warm receptors of sensation in the deeper tissues are likely to be much less abundant than in the peripheral tissues.

Application of Electrodes. — A definite advantage of short wave diathermy is the use of electrodes that are not in actual contact with the skin. Contact electrodes on skin areas over bony projections are difficult to place and maintain in position. There is also some difficulty in making good electrical contact which is essential for the prevention of burns. The removal of electrodes to a position away from the skin is made possible in short wave diathermy by the increased frequency as already mentioned.

Distribution of Energy. — The use of short wave diathermy with electrodes at some distance from the skin results in a more uniform production of heat throughout the tissue than occurs with contact electrodes. With contact electrodes the greatest heat production is in the skin and subcutaneous tissue in the vicinity of the electrode. As the electrodes are removed further and further from the skin, this selective heating of the part near the electrode is replaced by a more uniform heat distribution. Short wave diathermy is therefore preferable if heating of the deeper tissues is desired without material peripheral heating.

Selective heating of a tissue can theoretically take place if the tissue has certain particular values of electrical conductivity and dielectric constant and if the frequency has a certain optimum value. This selective heating has been clearly demonstrated in test tube experiments with salt solutions. Selective heating has also been demonstrated though less clearly, on dead tissues by McClennan and Burton.[3] In living tissues the conditions are more complex and selective heating of a deep organ without an accompanying peripheral heating has not

been shown. A reason for this is that a deep tissue such as bone is surrounded by muscle tissue which is a good electrical conductor. The muscle tissue behaves as an "electrical shield" to the deeper tissue and reduces the electrical field within the bone. This shielding effect can counteract the selective heating which bone may possess due to its characteristic dielectric constant and conductivity. More work on this subject is necessary.

Possibility of Burns. — In short wave treatment there are two opposing influences which determine the temperature of a tissue. One of these is the heat production which is approximately uniform throughout the tissue, the other is the blood flow. The temperature of the tissue will be decided by whichever influence predominates. Since short wave diathermy tends to heat the deeper as well as the more peripheral tissues it is necessary to take into consideration the blood supply of the deeper organs. Some tissues have a deficient blood supply notably, compact bone, cartilage and the vitreous humor of the eye. Such tissues are likely to be heated without being sufficiently cooled and burns may occur.

Selective Chemical Effects. — The development and use of short wave diathermy has opened a new region of the electromagnetic spectrum between the region of radio waves and the long infra-red. In this hitherto unexplored region of the spectrum it is of great theoretic and practical interest to know if any of these radiations produce selective chemical effects not attributable to heat, similar to those effects produced by ultraviolet in the formation of vitamin D or the production of erythema. Some authors have reported observations on the destructive action of these radiations on bacteria and bacterial toxins which occurs without a rise in temperature. Others have noted changes in the physical properties of blood serum such as surface tension. There is, however, a considerable controversy being waged on this topic. American and English investigators, notably Mortimer[4] and Osborne and Curtis, Dickens and Evans[5] have found no specific effects other than those of heat. German investigators, notably Schliephake, believe to have found some effects. It is generally agreed that a tissue situated between electrodes of a short wave diathermy machine and therefore in the electrical high frequency field, absorbs energy from the field. This energy is converted into heat and it is possible to have destructive chemical effects resulting from too high a temperature, such as protein coagulation. At the present time we must conclude that any other chemical effects are not definitely proved, but the possibility still remains that they may be found.

Summary

It may now be stated that short wave diathermy has proved to be a useful clinical mode of therapy. Its especial advantages are contained in the relatively greater heating of deeper tissues without excessive surface heating and the possibility of using electrodes not in contact with the skin. These advantages are due to the high frequency of the alternating current. The disadvantages consist in the uncertainty of estimating the true heating current and the possibility of deep burns in tissues with a poor blood supply. For these reasons heat treatments should be given under strict medical supervision by a specialist in this form of therapy.

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FRACTURED HIPS IN THE AGED: IMPROVED PROGNOSIS THROUGH PHYSICAL THERAPY *

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and

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For many years surgeons have sought ways and means to preserve the lives of persons with fractured hips and to secure useful end results. Traction over the end of the bed plus sand bag immobilization was the rule[1] until in 1871 Hodgen[2] described the swinging double inclined plane splint that bears his

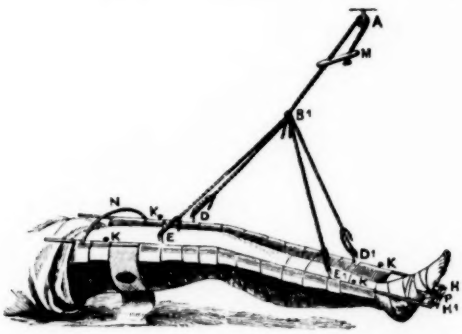

Fig. 1. — Hodgen's Suspension Splint. Effective in many cases when accurately applied, it is inadequate by the limited range of active and scant passive motion due to extensive covering of the limb.

name (fig. 1). It is still employed by many surgeons. The splint was an innovation in that successful results made it clear that absolute immobilization of the fractured hip is not essential for firm union. With the limb properly rotated into position, adequate traction on the distal fragment and careful suspension of the splint, the patient was fairly comfortable and nursing care was simplified. It also permitted that most important phase of physical therapy — active motion of the thigh.

The popularization of skeletal traction brought about greater accuracy in the position of fragments, more comfort for the patient, and increased possibilities in physical therapy. The limb could be exposed for massage and muscle training since the skin was no longer covered with adhesive strips or blisters. The direct, positive pull on the bone gave the patient reassurance to move his body and uninjured limb. Overhead bar and trapeze came in for daily use.

Plaster-of-paris immobilization by single or double spicas permitted greater movement of the patient by attendants but did not give the range of either active or passive motions. The ambulatory cast had been used for younger and more robust individuals since the middle of the 19th century. Recently a more effective walking cast with a heavy plaster shelf under the tuber ischii has been devised by Xeno,[3] of Argentine. This has been of particular help to patients who can tolerate the weight of a "skin cast" and can use crutches.

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The Well thigh countertraction splint[4] has produced excellent results for both transcervical and transtrochanteric fractures. We believe that in the latter type it is the best treatment now at our disposal since patients obtain immediate complete reduction and relief from pain. Within twenty-four hours they are out of bed and in a wheel chair. Physical therapy is employed in the active motion incident to sitting up and the free use of the arms and trunk. Passive motion is made possible by massage and the use of the sinusoidal current to muscles of the upper thigh.

The idea of surgical fixation of intracapsular fractures of the neck of the femur received great impetus with the employment of the flanged nail.[5] Variations have been many and few surgeons will care to state dogmatically which is the last word. The important feature is to make the surgical fixation exact and firm. We use the technic and instruments described by various surgeons. Local analgesia is satisfactory but spinal anesthesia in patients tolerating it gives complete relaxation and permits more accurate reduction. Coaptation of the entire fractured surfaces is essential in this area. Phemister[6] has pointed out that the blood supply is limited and the periosteum shows practically no osteogenetic activity. Callus forms almost entirely within the neck, so that there is no splinting by heavy callus formation about the exterior of the bone as in fractures distal to the capsule.

Closed reduction as described by Leadbetter[7] is used and verified by x-rays. The lateral incision over the trochanteric and subtrochanteric area ranges from 3 to 6 inches, depending upon the size of the extremity. The femoral neck can be palpated through the incision and the limb further rotated if the fracture line has not been fully reduced.

With a Baily[8] introducer, a wire 3/32 of an inch in diameter is drilled through the axis of the neck into the head. The heavier wire is preferable because it can be more accurately placed and will not shift to misdirect the flanged nail as it is introduced over it. (On occasion we have observed that a perfectly applied fine wire of the Kirschner type caught against the edge of the flanged nail, causing the latter to deviate from the true axis of the neck and head.) The larger, cannulated flanged nail is then driven over the guide wire in typical fashion and the wire removed. It must be remembered that as Smith-Petersen[5] has pointed out, the final step in the nailing is impaction of the fragments just prior to closure of the soft tissues.

Accurate reduction, introduction of a large flanged nail through the neck and full bony thickness of the head, and final careful impaction of the fragments enable the surgeon to omit all splints, casts, and other methods of immobilization. Mild flexion of the thigh and leg over pillows while in bed gives added comfort on the first day.

Physical Therapy

From this moment on the chief objective is an early return of power and function. The first step is to place the patient in a wheel chair the day following operation. It may not be practicable to have him sit bolt upright at once, but the getting out of bed as a matter of course is of major importance Otherwise a prolonged period of bed rest is likely to ensue. Attendants must be instructed to move the patient gently. Pain from unnecessarily rough handling will defeat the purpose of early activity. Within forty-eight hours after the nailing of the hip, systematic physical therapy is instituted. The first purpose is to tone and build up the musculature of the thigh and lower leg. In so doing we not only improve the circulation but also enable the muscles to perform the work for which they will be called upon in due time. In this connection we are not unmindful of the harm

which is so often done by allowing patients to stand and walk on weak and unsupported feet, following a siege of confinement in bed. We therefore also give due consideration to the strengthening of the lower leg muscles. An application of heat in one form or another should precede any plan of exercise, whether passive, active, or assistively active, since it is well known that a warm muscle functions more effectively. An infra-red unit is suggested because of its efficiency and simple application. It may be used for three or four half-hour applications. Cooling the skin surface at intervals of five minutes enhances the heating effect, leaving the muscle in a tonic rather than an atonic condition. If no infra-red apparatus is available, the simple application of hot and cold fomentations to the thigh and leg serves the purpose. The hot compress may remain in position from a period of four or five minutes, should then be removed and one wrung out of cold water applied for about a minute. This procedure is repeated for about twenty or thirty minutes.

The question of applying prolonged, deep heat over the fracture area by the short wave is a moot one and questioned by some workers whose findings and interpretations are adverse to its use.[9] Added to this the factor of uncertain dosage common to short wave units and the known fact that actual tissue damage has been done following the application of too intense heating, leaves us unable to escape the conviction that short wave treatment of fractures must be used with extreme caution.

It is desirable that heating be followed by gentle massage of the muscles. It is essential that deep manipulation be carefully avoided and only gentle movements be applied. This augments the effect of heat and is comforting to the patient.

We have noted the need of heat and massage in the after-treatment of fractures of the hip, but hasten to add that, in our opinion, the most important single factor is intermittent contraction and relaxation of muscles, this being essential for the normal return of venous and lymphatic circulation. Such movements are active voluntary exercise instituted and performed by the patient himself. This is, however, much easier stated than done, for caution must be used in avoiding too strenuous a form of movement which would defeat our purpose. For example, it is unwise during the first three or four weeks to permit the patient to raise actively his extended leg, because the movement puts too great a strain on the hip joint — this is especially true of the knee joint which is also involved. Weight lifting and weight bearing must be minimized. Our plan therefore, is at first to perform passive motion, bringing the extended leg in abduction, adduction and flexion. We also flex the knee as far as conditions permit and pay especial attention to movements of the foot. To prepare the patient for the active exercises to come, electrogymnastics with the sinusoidal current is used to bring about gentle contractions of the muscle mass of the thigh. This may be undertaken as soon as the area around the surgical wound is relatively free of tenderness which, in our experience, is about a week following operation.

We are now ready for a plan of voluntary active exercise. At first this must be free of the strain of weight-bearing as well as weight-lifting. We employ one of several devices which have for their main purpose the elimination of both gravity and friction. A smooth, well powdered board may be placed under the leg and a leather cup under the heel of the patient, which will allow a relatively easy abduction and adduction movement of the leg. The roller skate ball bearing device mentioned by Gaenslen, or gliders such as are put on the bottom of chair and table legs, may be attached to

a foot device thereby decreasing the element of friction. Another form which has been found to be advantageous and may be easily applied is suspension of the leg in a sling which is attached to an elastic band, or else one of the Guthrie Smith[10] type (fig. 2). These devices reduce gravity to a mini-

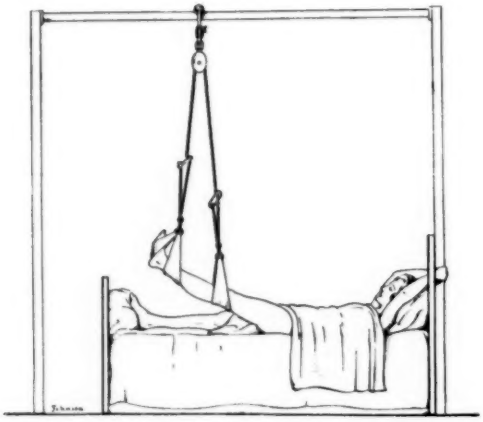

Fig. 2. — Guthrie Smith's Sling Apparatus. Mechanical fixation of intracapsular fractures of the hip permits the use of this effective and simple exerciser.

mum, thereby enabling the patient to carry on simple, voluntary exercises of knee flexion, abduction, adduction and flexion of the thigh. Whatever contrivance may be used, the patient is encouraged to institute short periods of exercise over the entire day, with each dose being relatively small. The patient is cautioned always to stop the exercise short of fatigue.

Barring the exceptionally robust patient, actual weight bearing is not to be permitted until x-ray examinations show film union at the fracture site. An elderly person is diffident in the handling of crutches. It is suggested that his first attempts to stand, from either the wheel chair or bed position, be supported by a firm chair. The patient can balance himself by holding onto the top of the chair in front of him. Within a day or two following this he will be able to push the chair ahead of him and accompany it step by step. Some patients use this as a sole means of assistance until they are able to walk without crutches or other support. After he has become accustomed to balancing himself in the upright position, crutches of proper length and width with non-skid tips of the vacuum cup type are to be used. Roughened surface on the tips is inadequate. The art of handling crutches is made easier if preceded by the simple act of pushing a chair, thus establishing a sense of equilibrium and security. Crutches must be accurately measured for the individual case. The handing down of such surgical aids from one patient to another is to be condemned, because too often the crutch tip is shortened to fit the next patient, resulting in a maladjustment of the arm span. As time goes on first one then both crutches are replaced by a cane until such time as this too, can be discarded.

Modern surgical measures have not materially decreased the time that must elapse before full weight-bearing can be permitted. Modern physical therapy greatly shortens the convalescent period that follows the start of weight bearing by putting the muscles and nerves in condition to be used as soon as bone repair permits attempts to walk. The immediate use of physical therapy eliminates the depressing period that comes to the elderly person who finds himself suddenly helpless. The fact that his attendants

are planning for him to walk again does as much for his morale as the moving about for his physical well-being. The continuation of active motions in the suspension sling, give the patient confidence and ability to maintain strength and control of the injured limb.

Recent reports from one of the large fracture services resorting to a maximum of modern surgery give the mortality in fractured hips as about 40 per cent. The service is too large to employ the maximum of physical therapy. Without a statistical review we have seen patients of advanced years (figs. 3 and 4) go on to restoration of health and usefulness with the

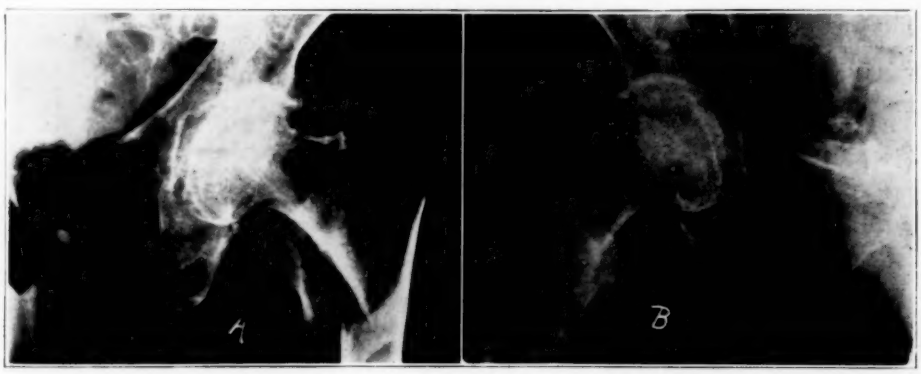

Fig. 3. — Intertrochanteric fracture of the hip. (A) Prior to reduction; (B) Six weeks after reduction.

Fig. 4. — Intercapsular fracture of the hip. (A) Prior to reduction; (B) Six weeks after reduction.

employment of rational physical measures in addition to modern surgical methods.

The increasing incidence of fractured hips as well as the larger number of persons living to an advanced age to have such injuries, make it imperative that steps be taken to reduce the mortality and the number of persons doomed to helplessness during the remainder of life. Reduction of fractures about the hip by modern methods is but the first step in surgical care. To capitalize on these splendid beginnings physical therapy must be utilized as an important auxiliary. Not only will it make the patient comfortable and sustain his morale but also maintain his physical strength and enable active metabolism definitely to lower the mortality rate from the complications that arise in this grave injury.

Clinical Reports

The following two cases are presented briefly to illustrate the effectiveness of combined surgical with physical therapy in the serious type of fractures under discussion:

CASE 1. — M. K., female, 79 years of age. Seen at the Luthern Hospital with Dr. C. E. Moeller. X-rays by Dr. E. W. Spinzig. Roentgenogram taken the day following injury shows comminution of fragments, avulsion of the lesser trochanter and coxa vara deformity (fig. 3, a). Roentgenogram taken six weeks later shows normal position of fragments — good union. A Well thigh splint was applied twenty-four hours after injury and removed six weeks later. Patient was up and about in wheel chair daily (fig. 3, b). Physical therapy as described in the text was resorted to at the first evidence of union.

CASE 2. — J. J., female, 80 years of age. Seen at Barnes Hospital with Drs. Duff Allen and B. F. Menefee. X-rays by Dr. Sherwood Moore. There was marked shortening with coxa vara (fig. 4, a). Six weeks after internal fixation without external immobilization there was excellent position and union was progressing. Twelve weeks following the application of a flanged nail the patient was able to do partial weight bearing on this hip with the aid of crutches and assistants. Had received daily treatment in the Department of Physical Therapy, Barnes Hospital (fig. 4, b).

Conclusions

Improved operative procedures supplemented by physical measures have materially reduced the mortality rate and shortened the convalescent period of the aged suffering from fractures of the hip.

These physical measures consist of the application of heat, massage and muscle contraction by proper electrical devices and, most important — voluntary active exercise.

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THE GALVANIC VESTIBULAR REACTION

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Early in the nineteenth century, Jan Purkinje,[1] a tireless investigator in many phases of medical science, became interested in the subject of vertigo. He made rotation experiments upon himself and others and noted that the resulting vertigo varied with the direction of rotation and the position of the head; he also observed the nystagmus which accompanied the vertigo. In 1820 he wrote as follows:

> I constructed a medium galvanic battery of 20 pairs of plates with a guitar wire leading from each pole. I put the guitar wires in both external canals. After the light appearances (phosphenes) and metal taste, I felt at once a sensation of vertigo in the head which appeared to travel transversely from one ear to the other and to move the head in this direction. This was from left to right when the zinc pole was in the left ear and in the opposite direction when the poles were reversed. After about ten minutes I could not stand the intense nausea any longer and discontinued the experiment. When the current was carried through the other diameter of the head (antero-posterior) I could not experience any vertigo. It is difficult to state whether this type of vertigo arises in the brain or in the skull.

The observations of Purkinje inaugurated a century of exhaustive research on the phenomena of vertigo and nystagmus, including those produced by galvanic stimulation. While most of the work consisted of studying the effects of surgical procedures upon animals in an effort to clarify the role of the labyrinth and its cerebral connections, the galvanic vestibular reaction maintained its interest for the investigator in this field. Such men as Breuer[2], Ewald,[3] Hitzig,[4] Bárány,[5] and others[6] who are responsible for many of our current concepts about the labyrinth conducted experiments with electric stimulation of the vestibular structures and speculated about the mechanics of the resulting phenomena. Although a considerable literature has accumulated regarding the galvanic vestibular reaction there are problems in this connection which still remain to be solved.

Vestibular Phenomena of Galvanization

Early investigators used wires or metal balls which were placed in the external auditory canals. Later metal electrodes over the mastoid processes were used. MacKenzie[7] employed an arc with an electrode in front of each tragus. This method eliminates a certain amount of discomfort which results when the electrodes are placed on the mastoid process. For the method of testing one ear the indifferent electrode is placed upon some distant part of the body. One may use a wire band on one end of which is a felt electrode and on the other a bakelite cap which can be unscrewed if it is desired to employ the bilateral test; for unilateral stimulation the other electrode is fastened by means of a cuff to the opposite wrist. If felt electrodes are used they must be well saturated with tap water or salt solution. The old wall plate is still favored by some men, but I find that a good battery with a milliammeter attached is much safer and more comfortable for the patient.

Most of the early work was done with the bilateral method — the anode on one side of the head and the cathode on the other. It is recognized that this method gives a summation effect from both vestibular systems. With

the unilateral method anodal or cathodal stimulation is confined to one side. That a galvanic stimulus can be limited to one vestibular apparatus has been shown experimentally by Brunner[8].

The phenomena arising from the passage of a galvanic current through the transverse axis of the head are:

1. Vertigo, consisting of false sensations of rotation of the surroundings and a sensation of falling toward the cathode. The first is the "tactile error" of Purkinje, the second takes place especially when the eyes are closed. With relatively weak currents these sensations may be purely horizontal, with increasing strength the direction of apparent rotation assumes different planes usually of a complicated pattern. Vertigo is manifested more readily when the circuit is opened or closed quickly. Vasomotor phenomena or nausea are uncommon unless the tests are unusually prolonged.

2. Nystagmus. This was first noted as a result of galvanic stimulation by Hitzig[4]. It is rotary or horizontal-rotatory in nature, of small amplitude and the direction is always in that of the flow of current, i. e., from the positive pole toward the cathode. The opposite reaction has been reported in head injury cases by Rhese[9], but I have never observed this phenomenon in a series of several hundred such patients. My method is to examine for galvanic nystagmus with the Frenzel glasses (illuminated convex lenses, the source of light being furnished from a small battery held in the patient's hand) on the patient, using the unilateral technic. In this way the amount of current required to observe a reaction is much reduced. The nystagmus, like the vertigo, has a tendency to subside in rhythmic periods as the point at which it first appears is passed.

3. Tonic disturbances of the musculature of the neck, trunk and arms. Deviation of the head to the side of the anode was noted by Hitzig as a feature of galvanization of the head many years ago. Bárány showed that past-pointing is induced by the galvanic test similar to that resulting from other methods of vestibular stimulation. The armtonus or so-called discobolus reaction was demonstrated by Fischer and Wodak[10]. Falling or a tendency to fall may be elicited with minimal galvanic stimuli by special maneuvers, such as placing one foot before the other, while the feet are still together or by employing the technic of Blonder[11] using a balance board which is particularly adapted to this test. In general, it should be stated that the equilibrium disturbances produced by the galvanic current follow a pattern which is similar to that obtained from rotation or from caloric stimulation of the labyrinth. They are invariably in the direction of the slow component of the nystagmus and opposite to the vertigo sensation. All the galvanic phenomena differ, however, from those produced by other methods of labyrinthine irritation, in that they are not affected by changing the position of the head.

There has been some controversy regarding certain features of the galvanic vestibular phenomena. Differences of opinion exist, for instance, as to whether nystagmus or falling occurs first; some authors have even claimed that past-pointing is seldom elicited. It should be stated at once that the galvanic vestibular effects are not as pronounced as those of the caloric and rotation tests. However, with appropriate technic, it has been my experience that all of the phenomena with the possible exception of vertigo which being a subjective reaction is difficult to evaluate, can be readily elicited. Nystagmus, as previously mentioned, I always examine through the Frenzel glasses; past-pointing is performed with both arms simultaneously using the original Bárány method of raising the arm from below up, touching the examiner's finger and returning to it again; and falling should be tested either with Blonder's[11] or Mann's[12] technic. Theoretically the stim-

ulus should affect all the secondary connections of the vestibular nerve simultaneously; practically I have found this to be true or almost true if the technic employed is equally sensitive for nystagmus, past-pointing or falling. To illustrate concretely: with Blonder's balance board falling with the unilateral test requires usually 1-2 ma., rarely 5 ma., while nystagmus with the same method requires 15-20 ma.; however, with the Frenzel glasses a 2 degree nystagmus is observed usually with 3-4 ma., rarely with 6 ma., while Gertz[15] noted with the ophthalmoscope eye movements with 1 ma., an observation which I can substantiate.

Site of Galvanic Stimulation

This is without doubt one of the most controversial questions in vestibular physiology. Aside from the scientific interest involved, there is the practical consideration that if the exact place where the galvanic stimulus is exerted were known the diagnostic value of this reaction would be considerably increased. The problem therefore merits discussion from more than one standpoint.

The earliest investigator, Purkinje, believed that the galvanic reaction probably took place in the brain. It is curious that although the dramatic experiments of Flourens on the labyrinth of pigeons were known to him, he did not connect the results of either his rotation or his galvanic experiments with the vestibular apparatus. Hitzig, who made a considerable study of the galvanic reaction, thought that the site of the vertigo was in the cerebellum but that the nystagmus was due to the effect of the current on the cerebral oculo-motor centers. Spamer[6] and Breuer[2] thought from their experiments that they were able to stimulate the semi-circular canals but this was disputed by Ewald, who as a result of hundreds of experiments came to the conclusion that the galvanic current affected only the nervous structures connected with the labyrinth.

With the renewed interest of clinicians in the labyrinth that followed Bárány's discovery of the caloric test, the galvanic test was scrutinized more closely by otologists and it was found that the reaction could be obtained in patients who had undergone labyrinthectomy. Bárány and the Neumann school came to the conclusion that the site of galvanic stimulation was the vestibular nerve and taught that by means of this test a lesion of the nerve should be distinguished from a dead labyrinth. To account for the fact that a reaction could be obtained with either the cathodal or the anodal current, Bárány applied the well known Pflüger's law dealing with motor nerves to the galvanic reaction. He stated that the galvanic current produced a state of increased irritability when the anode was applied to the side being stimulated (anelectrotonus) and a state of diminished irritability (catelectrotonus) when the cathode was used, the resultant phenomena in the latter instance being due to the unopposed action of the opposite labyrinth.

Brünings[14] disputed this theory on the ground that the caloric or rotatory stimulus applied during the galvanic test did not indicate that the irritability of the vestibular apparatus was actually either increased or diminished. He believed, without offering any proof, that the reaction came about as a result of cataphoresis in the endolymph of the semicircular canals, producing a current so that the cupula was affected in the same manner as by the rotation or the caloric test. Of all these theories that of Bárány and Neumann was probably the one most accepted.

The most recent work of note on the subject is by Dohlman whose careful study on animals and summary of the literature deserves commendation. He came to the conclusion that the site of the galvanic reaction is the

ganglion of Scarpa in the internal auditory meatus. He based his theory mainly on the fact that although he could still obtain the galvanic reaction following the destruction in rabbits of the labyrinth and its sensory epithelium, he could not obtain a reaction by stimulating the central end of the severed vestibular nerve with as much as 10 ma. He believed that the cathode strengthened the normal tonus of the ganglion and the anode weakened it, so that the reaction came from the unopposed action of the other labyrinth.

What can be our attitude on this question? There are objections to all of the theories, including that of Dohlman. The endolymph current theory of Prüning, while momentarily attractive to one who has in mind the action of a current on a container of electrolytic solution falls to the ground if two facts are borne in mind. First, the galvanic reaction stops at once when the current is shut off — a phenomenon entirely contrary to the behavior of the labyrinth in rotatory and caloric stimulation. In the latter it is definitely known that a current is set up on a tendency to a current in the semi-circular canals and also that the effect always continues in a normal individual for some time after the stimulus is discontinued. A second objection is the indubitable fact, both clinically and experimentally, that a galvanic reaction can still be obtained after the labyrinth has been destroyed. This would also dispose of the sensory epithelium of the labyrinth as the site of stimulation. The objections to the theory of Bárány have already been given. There finally remains Dohlman's[15] hypothesis, namely, that the site of the galvanic stimulation is Scarpa's ganglion. With due respect for the thoroughness of his work there are two statements or rather conclusions in his work that I should like to challenge. First, Dohlman found that an electrode placed on the central stump of the severed vesticular nerve gave no ocular deviation (with 10 ma.) and therefore came to the conclusion that the vestibular centers in the brain stem are not stimulated by the galvanic reaction. I have, however, been able to obtain a typical unilateral galvanic reaction with nystagmus and body deviation in a man whose eighth nerve had been completely severed intracranially and who showed all the clinical manifestations of a dead labyrinth. The amount of current was about 20 ma., Frenzel glasses were used, and either anode or cathode was effective. The other side gave a reaction with 6 ma. I believe therefore that it is possible to obtain a galvanic reaction from the central vesticular area.

My second objection is that Dohlman took no account of the undoubted fact that it takes more current to produce the galvanic phenomena when the labyrinth has been destroyed than when it is intact; this has also been proved experimentally. If Scarpa's ganglion were the site of stimulation this would not be the case.

Dohlman reached his conclusion on the basis that Scarpa's ganglion was the only structure between the labyrinth, destruction of which did not abolish the galvanic reaction, and the severed central end of the vestibular nerve. He took no account, however, of the endings of the ampullar branches of the vestibular nerve structures which in my opinion are more likely to be the chief though not the only site of the galvanic reaction than any other portion of the vestibular tract.

It should be borne in mind that the vestibular is a sensory nerve. Not only does it produce a specific sensation — vertigo — but those fibers which connect with the oculomotor centres and those serving the musculature of the body must be considered as the sensory portions of reflex arcs. There is one important characteristic, however, which differentiates the vestibular from other sensory nerves. Each labyrinth, because of the fact that a cur-

rent of endolymph can proceed in either one of two directions, can produce vertigo, nystagmus or bodily deviations in either of two directions, so that the vestibular nerve endings are capable of stimulation to give either of two opposite effects. Presumably different fibers transmit these two stimuli although this has not been proved experimentally. It seems to me that it is unnecessary to assume, as was done by nearly all investigators from Ewald down, a depressing effect to explain the results of anodal galvanic application, if we consider that the vestibular apparatus can be stimulated in two different ways. It can then be simply said that the anodal galvanic stimulus is similar to cold water and the cathodal to hot water.

In summing up, it is my belief that the galvanic vestibular reaction is largely the result of the effect of the current on sensory nerve endings much as light flashes are produced from the retina or noises from the cochlear apparatus, but that to some extent with large amounts of current the central structures may also take part in the reaction.

The nature of the changes in the nervous structures which take place during the galvanization is impossible to state since so little is known of the inter-polar effects of an electric current applied to the body. One may surmise that it is probably an electrochemical change not greatly different from that which occurs in other forms of stimulation. It should be remembered that also electrical changes of potential-action currents are a demonstrable feature of nervous impulses.

Clinical Value of the Galvanic Reaction

In the light of the foregoing discussion it can be readily understood that the galvanic vestibular reaction possesses only a limited diagnostic value. Not only is there reason to doubt that the stimulus is exerted exclusively in one portion of the nervous structures connected with the labyrinth but as the effect is a mass reaction — i. e., it is not possible to limit the stimulus to nervous elements of one canal, the clinical value of the test is further diminished. Neither in my own experience or in the literature have I been able to find any characteristic syndrome or abnormality of the galvanic reaction peculiar to any given disease condition.

Some men have attempted to establish a standard for the amount of current required to produce a galvanic reaction. My belief is that all so-called normals must be within wide limits. Not only is the technic employed of great importance, as already mentioned, but the thickness of the cranial bones, the mental state of the patient, the size and type of the electrodes and the source of the current are all factors which may affect the result if one is trying to ascertain the threshold stimulus and compare it to "normal" standards.

The most practical use of the galvanic vestibular reaction lies in a comparison of the amount of current required for each side, with the unilateral method. MacKenzie, thirty years ago, made the right approach to the problem by showing that although there were wide variations in the amount of current needed to produce a reaction, such as nystagmus, there was never more than 1 ma. difference between the two sides in the same individual. His work has been confirmed and extended more recently by Vogel[16]. The test may be used in this manner to diagnose or corroborate a vestibular imbalance and it has been my experience that particularly in head injuries it is quite useful from this standpoint. It should be pointed out that if the test is made using alternately the anode and cathode on each side, there will be, if there is present a spontaneous nystagmus or a tendency to a spontaneous nystagmus, not only an abnormal difference between the two sides,

but also a difference between the amount required on each side for the anodal or the cathodal stimulation. That test on either ear which tends to reinforce the existing nystagmus tendency will require less current than one designed to produce a nystagmus in the opposite direction.

A few words may be said about vestibular chronaxia since this is related to our subject. Chronaxia may be defined as the shortest time necessary to produce a response such as a nystagmic movement by stimulating a nerve with a current twice its rheobase. By the latter term is meant the smallest voltage of galvanic current required to produce a muscular contraction. The subject is being widely discussed among electrophysiologists and neurologists and has already found considerable application in certain fields of medicine. Bourguignon[17] and others have experimented with chronaxia of the vestibular nerve, using either vertigo or a movement of the head as the response. Their findings are interesting as they harmonize with the conclusions drawn by other observers in regard to entirely different tests, such as the pulsion reflex. For instance, it has been found that vestibular chronaxia is the only one which varies widely between individuals, the emotional persons showing the lowest chronaxia and the phlegmatic ones the greatest. Bourguignon also pointed out that there is a different chronaxia for movements in different planes of space corresponding to the action of different semi-circular canals. It would seem from these facts that in the absence of fairly definite normal standards for chronaxia of the vestibular nerve no great practical use can be anticipated for this test at this time.

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Discussion

Dr. H. Brunner (Chicago): Dr. Shapiro is to be commended for the choice of his subject because the galvanic test is not sufficiently well known among the profession in spite of its clinical importance. Compared with others the galvanic test has the disadvantage that it demands for its practice a meticulous technic for use in clinical examination. I think that we can safely assert that the galvanic reaction originates in the vestibular nerve. That does not mean that it does not also irritate the vestibular ganglion. It is quite possible that in a normal case the galvanic test acts differently from that without a labyrinth. In other words, it is possible that under normal conditions the reaction originates in the vestibular nerve and in the ganglion, while in those in whom the labyrinth with the ganglion is destroyed, the test evokes its response from the nerve only.

I have used this test for many years in the following manner. I always examine with the bilateral method. The first reaction obtained is always the falling one, which is directed towards the anode and independent of the position of head. This reaction can be initiated with 1 to 1½ ma. provided that the so-called heel-toe position will be employed. With 3 to 5 ma. one may obtain a galvanic nystagmus which is markedly rotary and is always directed towards the cathode. So far as the pointing test is concerned I am sorry that I can not quite agree with Dr. Shapiro. The past-pointing in the galvanic test is elicited more effectively when one examines within the frontal plane. This means that you examine the past-pointing upwards and downwards because the whole reaction of the galvanic test happens in the frontal and not in the horizontal plane. Therefore, the past-pointing to the right and left is less marked than the past-pointing up and down.

The practical value of the galvanic test is important. Many years ago, my teacher, Professor Alexander, introduced the galvanic test in the differential diagnosis between congenital and acquired deafness. We know today, with certainty, that in acquired deafness as a rule there is no response to galvanic tests but that in congenital deafness there is a definite one obtained. The galvanic test is probably also useful in the diagnosis of acoustic tumors. I have examined a number of such cases with the galvanic current. This work is not as yet concluded, but I should like to point out that some acoustic tumors do and some do not influence the results obtained with this test. It is possible that in the latter cases the lack of response is the result of a degeneration of the vestibular nuclei. If this is correct, then such a test should be of great assistance to the neurosurgeon in that it would then be possible to give him pre-operative information whether or not the medulla oblongata is severely affected.

Dr. Edwin J. Blonder (Chicago): In testing by galvanic current one of the foremost considerations is noting the amount of current used, because it has been well established by clinical and experimental evidence that the vestibular nerve and central pathways may be directly stimulated. Small amounts of current stimulate only the labyrinth. The literature is filled with confusing results because the amount of galvanic current was not recorded. Dr. Loyal Davis and I reported at the American Medical Association convention in 1936, experiments on cats decerebrated by the anaemic method and subjected to galvanic stimulation of the auditory bulla. The tonic labyrinthine reflexes were noted and compared with an animal similarly prepared except that both eight nerves were sectioned at the internal auditory meatus. The labyrinthine reflexes were obtained with small amounts of current only when the eight nerves were intact. When 20 ma. were used the current spread throughout the animal. This experiment compares to the deaf case with a dead labyrinth stimulated with 20 ma. reported by the essayist.

Dr. Shapiro mentioned that the galvanic nystagmus is similar to the caloric nystagmus. The physical character of the galvanic and caloric nystagmus is distinctly different. Caloric nystagmus has a wide amplitude, not very rapid and is easily recognized by the observer when present. Galvanic nystagmus is very small and rapid and is difficult to recognize without the aid of convex lenses. What makes the difference? Increase of current will not bring the amplitude to that produced by caloric stimulation. Are we stimulating the same portion of the labyrinth with caloric and galvanic stimulation? Are the otoliths stimulated by galvanic stimulation? Further experimental evidence should be obtained by animal experimentations to answer these questions.

I do not agree that galvanic stimulation of the labyrinth has only a limited value. Probably that is true so far as the observation of nystagmus is concerned. Some individuals are stimulated very easily with galvanic current to produce nystagmus, while others require a great deal of current. Galvanic falling with the balance board, a test I devised and reported on various occasions, is very dependable and consistent and has proved in our hands to be as valuable as any of

the other labyrinthine tests used. In this test the patient stands on a balance board with one electrode on the mastoid and the other on the sternum. One to two, rarely as high as five ma. in normals produces anodal falling. No vertigo is present with this galvanic test.

Dr. Shapiro placed my galvanic falling test with the balance board and the galvanic falling tests in the Rhomberg position, or one foot in front of the other as the same. The results are not the same because a patient with a positive Rhomberg cannot stand with his feet together and eyes closed; this same individual spreads his feet apart on the balance board and he can be tested just as easily as a normal person. If a patient has a unilateral weakness and a hypersensitive labyrinth on the contralateral side, the galvanic falling reaction with a balance board would bring this out.

Dr. Sherman L. Shapiro (closing): The subject is one upon which considerable difference of opinion still exists. While I have covered most of the issues raised by Drs. Brunner and Blonder it may be of benefit to re-emphasize two points in so far as the use of the test is concerned. First, inasmuch as the galvanic reaction admittedly results from all the canals or vestibular fibers even in its unilateral application, it must remain inferior from a practical standpoint to the caloric test, which not only can be limited to one ear but also to either the vertical or horizontal canals. Second, the question as to whether falling or nystagmus is chosen as the means for gauging the galvanic reaction is one of individual choice or consideration; personally, I prefer the nystagmus observation since it is completely involuntary on the part of the patient, but even granting Dr. Blonder's points as to ease of application of the falling test with his method, the latter still remains subject to the handicaps previously mentioned which apply to all galvanic tests.

REPORT ON SPAS AND HEALTH RESORTS *

At the Annual Meeting of the Congress held in Cincinnati in September, 1937, a Committee was appointed to assemble data regarding the Spas and Health Resorts of the United States. During the year the Committee contacted various State Departments in the different States to obtain a list of places where special attention is given to the therapeutic use of natural agents, such as mineral waters, muds, climate, ocean bathing, etc. The Committee sent a questionnaire to 152 such places and 70 replies were received. The institutions replying represented the following types of work:

Spas	Inland	57
	Coastal	7
Climate Resorts	Inland	2
	Coastal	0
Not Operating		4
Total		70

In addition, 31 institutions were visited by one or more members of the Committee representing:

Spas	Inland	22
	Coastal	4
Climate Resorts	Inland	1
	Coastal	4
Total		31

The data obtained from these questionnaires and personal surveys reveal the following information. Detailed statistical analysis has not been made as the replies received to date have not covered the entire country.

* Committee Report Read at the Seventeenth Annual Session of the American Congress of Physical Therapy, Chicago, September 12, 1938.

1. *Ownership Control.* — Nine institutions are under direct governmental control and supervision either by the Federal Government, State Government or Municipal Administration. The remaining 61 are privately owned and operated.

2. *Type of Natural Resources.* — Mineral waters of types varying from thermal to saline are reported to contain either sulphates or chlorides, and sodium bicarbonate. In some of these, natural carbon dioxide or hydrogen sulphide was present. The waters vary in strength from .01 to 1.5 per cent of saline constituents. Muds for baths and packs are used in some places. These may be either the mineralized type or the organic moors or peats. Along the seashore bathing in some places is a controlled method of treatment. Institutions making particular use of their climatic opportunities were included.

3. *Type of Treatments.* — Drinking of the mineral waters is an important part of the treatment in many places. Bathing in individual tubs, pools, or the ocean is widely used. The muds are applied generally in the form of packs as moist heat treatment. Sun bathing is general and combined with climate to produce a therapeutic effect.

4. *Living Accommodations.* — These vary widely in the different institutions. In a few places, sanitaria with complete nursing and medical supervision are in operation. Hotels varying in capacity from 30 to 1,000 guests and boarding houses for 6 to 30 guests represent the major types of accommodation. In some places cottages and cabins are used. Variations in the cost of room and board in the different institutions range from $2.00 to $15.00 per day.

5. *Medical Supervision.* — In approximately 10 per cent of the places, strict medical control is carried out by physicians employed by the institutions. In other places the care of patients is left to private physicians in the community and usually amounts to only partial medical control. In a few places employed physicians supervise the treatments in cooperation with the private physicians. In other places, there is no medical control.

6. *Research and Investigation.* — An Institute for the study of waters and treatments was reported from one Spa. In others, laboratories for the control of springs and water and for the examination of clinical specimens were available. The clinical study of records of the patients is largely in the hands of the private physician and in a considerable number of places no laboratory research facilities were reported.

The Committee consider that a well organized Spa or climate resort should be characterized by:

1. The presence of natural resources such as mineral water, peloids (mud or moors) or climate which have therapeutic value.

2. Suitable physical facilities for administering of the above-mentioned natural therapeutic agents.

3. Competent medical supervision.

4. Adequate medical records and facilities for investigation.

The committee recommends this broad classification of such institutions:

I. Spas
   a) Inland (mineral waters and moors)
   b) Coastal (seashore, ocean bathing)

II. Climate Resorts
   a) Inland
      1. Altitude — high
         — low
      2. Desert

b) Coastal
   1. Temperate
   2. Subtropical

The existence and further development of spas and climate resorts are justified because:

1. There are many patients with chronic diseases prevalent in this country who can obtain more relief in spas than elsewhere.
2. For the healthy individual, vacations spent at health resorts properly supervised are an excellent method for keeping fit.

The spas and health resorts of the country are facing very definite problems at the present time, with a decrease in patronage and resultant financial difficulties. This decrease in patronage seems to be due to a number of factors, among which the following are of considerable importance:

1. *Economic.* — Many institutions have large and expensive establishments requiring a large overhead for maintenance. During the past years with a change in the economic status of many of our citizens, visits to these places have been less frequent and of shorter duration. In some places, the Spa management emphasized other attractions than the health possibilities. They have allowed sports and gambling to predominate to the exclusion of rest, quiet and relaxation necessary for the proper regime. They also have catered to conventions in order to break even financially.
2. *Lack of Interest.* — In this country there is a definite lack of knowledge and consequent lack of interest by the physicians regarding the use of spa facilities because reliable information is not available from sources which carry authority and because the proper use of the spa and climatic treatment is not taught in our medical schools.
3. *Unfounded Claims.* — In some places the spas have published claims regarding their value which are unfounded.
4. *Medical Supervision.* — There has been a lack of good medical supervision and proper medical control in many places.
5. *Development.* — With restricted income many places have made no effort to keep up their facilities and develop them in a modern way.

To meet the present problems and enable the proper further development of the spas and climate resorts, the Committee feels that it is necessary to:

1. Discourage the use of unfounded claims and testimonials in the printed literature.
2. Encourage proper medical supervision with clinical and laboratory studies of their natural resources and their application in treating patients in order to establish sound indications.
3. To encourage the presentation of established facts and sound clinical information to the medical profession. This may be accomplished by
   a) lectures on hydrotherapy, balneology and climatology in medical schools,
   b) the presentation of papers covering such subjects at medical meetings,
   c) invitations to physicians to visit and inspect the individual spas and climate resorts, which occasion may be used to convey facts regarding their work.
4. Encourage the development of facilities for use of spas and climate resorts at a cost within the reach of persons with moderate means.

(*Concluded on page 52*)

ARCHIVES of PHYSICAL THERAPY
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

ULTRAVIOLET AND SULFANILAMIDE IN SYSTEMIC INFECTION

Periodically contributions of special interest and significance have reached the profession related to the therapeutic extension of ultraviolet radiation to many of its serious clinical problems. Collectively these reports have indicated the definite need of life for light, and particularly the influence of light in combination with selected photochemical synergists on certain physiologic factors of importance to health and in defense against disease. Because of the known bactericidal effect of ultraviolet rays on accessible microorganisms and its stimulating and depressing action on certain physiologic constituents, search for a systemic antiseptic has been assiduously pursued. Koch's observation of the lethal action of sunlight on the tubercle bacilli and Finsen's demonstration of the clinical cure of lupus vulgaris by carbon-arc, stimulated a train of investigation that proved its negative and even dangerous action on pulmonary tuberculosis. Its positive and specific action in surgical tuberculosis, erysipelas and the rhachitic state once again awakened interest in phototherapy, and encouraged new search for a method of utilizing these sterilizing and curative rays for control of deeply seated vegetable microparasites.

The early and perhaps accidental discovery that the quality of these spectral rays was also associated with a mysterious property that provoked in certain elements a fluorescent action suggested inquiries in this direction as an interesting field for exploration. Among earliest observations was that individuals treated with fluorescent substances later became sensitized to ultraviolet radiation. Eosin in 0.2 Gm. doses prior to irradiation acted as a catalyzing agent and apparently reduced the time required for treatment of undernourished and rhachitic patients. Leersum[1] for instance, showed that injection of alkalinized hematoporphyrin preceding irradiation produced bone healing and improved calcification in rats even in the absence of normal light. György and Gottlieb[2] demonstrated that with a regime of 0.1 Gm. of eosin in 0.2 Gm. of powdered cane-sugar, children with rickets made quicker recoveries by mercury-in-quartz light. Photosensitizing adjuvants according to Jausion[3] enhanced recovery of rickets. This consisted of a polysensitizing prescription that included gonacrin, methylene blue, pyridine, or a photocatalytic calcium product that augmented calcification. The fluorescent quality of eosin, fluorescin and other similar substances in weak solutions prior to irradiation, has been acknowledged as highly germicidal. Photo-dynamic effects have also resulted from products of internal secretion, such as pituitrin, thyroid, insulin, adrenalin, pitressin and the like, which explains the improved clinical course of endocrinologic patients.

Investigations of ultraviolet radiation and photochemical adjuvants while of relatively recent date already have demonstrated the new trend of present research for control of deep seated infections. The introduction into general therapeutics in 1937, of sulfanilamide was the first example of the availability of a patent systemic antiseptic against bacteria, especially of the deadly beta hemolytic streptococcic variety. Its photosensitizing property was first suspected by Newman and Sharlet[4] following the appear-

ance of a scattered rash consequent to use of sulfanilamide. The fact that the rash was confined to the area which had been irradiated with ultraviolet and was sharply demarcated at the covered clothing suggested the need for confirmatory evidence to determine the synergistic value of the above combined therapy. Further studies not only revealed its photo-antagonistic action but gave rise to speculation whether this reaction could not be therapeutically controlled or modified for the greater benefit of patients. Since the mode of action of sulfanilamide is believed essentially to be that of a stimulating character by phagocytosis on the streptococci by the polymorphonuclear leukocytes and not in the nature of a direct bactericide, it became necessary to inquire just how its intake produced its pronounced effect. According to Lock, Main and Mellon[5] this new chemical remedy for a host of diseases owes its effect to its ability to manufacture in vivo a hydrogen peroxide substance. When dilute solutions of sulfanilamide were exposed to ultraviolet rays, it was observed that substances like hydroxylamine were produced. Vegetable pathogens such as the virulent hemolytic streptococcus and pneumonia microparasites depend for their growth and life on the enzyme, catalase, to hold in abeyance the peroxide they produce. The enzyme is however made inactive by the hydroxylamine and by substances related to it as enhanced by the saturated sulfanilamide alone or by the adjuvant factor of absorbed ultraviolet radiation.

Studies carried out from another angle but toward the same objective have directed its inquiry to the effect of sulfanilamide and pitressin as photochemical synergists. The preliminary report of Nedzel and Pincussen[6] published elsewhere in this issue needs no further comment than that it conveys provocative therapeutic implications both as to the importance and practicality of their findings as well as the diverse reactions obtained from the ultraviolet generators used. The fact that the profession has to date interpreted the factors of wavelength and intensity as the alpha and omega of quantity and quality of all therapeutic ultraviolet sources, is reason why further data is required to explain the marked discrepancy between the action of quartz and carbon-arc light in the presence of sulfanilamide intake. The fact that both carbon-arc and mercury-in-quartz irradiation decreased the death rate in mice systemically infected is important because it points to a new value of ultraviolet light as a possible systemic antiseptic. The findings of a striking and unexplainable death rate difference in the presence of sulfanilamide under irradiation of two dissimilar ultraviolet generators suggests that further investigations are needed to explain an antagonistic chemical factor and to confirm the favorable findings simultaneously reported.

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THE DOCTOR IN FICTION

Throughout the ages the doctor and his calling have been immortalized through the medium of prose and poesy, fiction and romance, because the richness of this theme has been recognized as a "natural" of inexhaustible variants for the cognoscente of the literary world at which to aim. While it is true that nothing can encompass the emotional stresses and strains based on factors related to the biologic urge such as love, hate and hunger, no more majestic, tragic or sweeter song has come from heart or home than that which was prompted by suffering and surcease of pain. Like the venerable Persian philosopher in Anatole France's *Golden Tales*, the doctor not only has seen but has been the gentle accoucheur of birth, and fought the valiant battle against suffering and death.

Thus the drama and the mystery of the healing art has from time immemorial been a story certain to fire the imagination, and no other type except the individual immersed in his dilemma of love confused, unrequited or satisfied has offered such a tremendous canvas for color and emotional appeal as the physician and his social environment. Every period having contributed its particular impressions, the profession today can look upon its fictional historic past as a collective individual whom Goethe immortalized in the tragedy of Faust; whom Molliére wittily pricked for his pedantry, hypocracy and avarice; on whom Dumas expanded the full flight of his imagination in those stirring romances where Joseph Balsamo and Cagliostro connived with pills and potions for pearls and Queens' necklaces; whom Cronin made climb a citadel sadly worm-eaten with dissimulation but still fundamentally rich in all the austere and humane virtues attributed to the profession, and on whom Brett Young has most recently dedicated his high creative and descriptive talent in the form of unforgetable romance that surrounds the doctor with pathos and poignant beauty.

The story of *Doctor Bradley Remembers* long will live in the heart of all readers because the theme is a homily woven out of the very cloth of possible experience of man's instinctive response for those of humble economic and social position whose health is the more precious because of their limited capacity to safeguard it. Into the smoke-grimed Black Country or coal district of England comes young John Bradley who had just been graduated from school at a time when Pasteur and Lister were still regarded as dreamers and adventurers, and at a period when the operative mortality was considered inevitable if not favorable if it did not exceed above 58 per cent. Written by a novelist of first rank who was graduated as a physician, one sees in this story the organized sympathies of artistic creation and vocational calling bent in a single direction to point as interesting and convincing a picture of the industrious country doctor contentedly working despite low fees and limited knowledge for love of his profession and his humble home.

The story of John Bradley is written from the retrospect of 50 years of diligent toil and opens with the aged doctor's last night in his old surgery at Sedgebury. He has just sold his practice to a young graduate for whom he has great respect because of his alert business sense and advanced knowledge. It is pointed out to him that his offices are antiquated and need special electric wiring for diathermy and other modern physical therapy equipment. He has scolded his last patient because she would not accept medicine, but after a forced loan he has written *paid* to this last account. He recalls the half a century of loving service and benign untruths told as merciful placebos to this small community. He sits back and dreams of

his rich life of toil and hope, of love and anguish following the birth and death of his children and wife. Nothing being so vivid as past events to the aged, he remembers his youth, his early struggles for a home and practice, his inability to attain riches or honors. It is a story that softens the heart, dims the eye and raises that strange lump in one's throat for sympathy and admiration of a simple, honest, humble member of the profession.

John Bradley was proud of his profession and gladly gave fifty years of service to mankind. He faces the few remaining years rich in memories crammed to bursting with the very stuff of reality but content in spirit. This being the most recent of contributions about the doctor in fiction, we find the latter modernized in equipment but still the immortal figure that has trod the ages as the healer of the sick and the mentally distressed. The cloth may perhaps seem more conventional but the spiritual pattern remains the same. As in the past, so also in the future will come to the doctor's office those whose lives are touched by impending tragedy to seek relief of that infinite variety of symptoms now more than ever definitely controlled by the ingenuity of the modern practitioner. It is certain that posterity will discharge its obligation with even greater intelligence but not with greater sympathy and honesty. And since the doctor in fiction is but the reflecting shadow of the living reality there awaits the future generations new heart throbs, suspense and gory thrills to satisfy the differing tastes of future connoisseurs about doctors in fiction.

Photoradiation in Animal Septicemia — Nedzel and Pincussen

(*Continued from page 8*)

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SCIENCE, NEWS, COMMENTS

Hollender Opens Offices in Miami Beach

The call of soft breezes, sunshine and swaying palms has often been too strong an attraction for even those who practiced the life strenuous in all that it connotes. Astonishing and, yea, saddening and maddening is the realization that one's companion in creative efforts had as it were "kicked over the traces and the bucket" and temporarily (we hope) forsaken his avocations to become another disciple of the worshippers of sunshine and moonshine under the subtropical climes of Miami. Dr. A. R. Hollender was one of those stout "fellas" who could even say a surgical nay to a defenseless hypertrophied tonsil. Whether it was weather that gave him uplift to practice the otolaryngorhino art in the manner that conferred courage to quaking septa and sinuses, weakened eyes and nerveless ears, certainly it was true that his professional touch was as gentle as it was broad or wide. While he could on occasion snatch a tonsil with the best, at least it is said that he snatched it with its trousers, capsule and all. Nothing was left after such an operation but the bill, and this unfortunately was often beyond reach of snare, clamp or scalpel. We pray that his skill will find a rich harvest among the moneyed many who toil less and play more, and come to Florida for rest and recreation. Let us hope that they get their recreation and Hollender the rest. Needless to say we wish him health and luck, and a quick return to Chicago. While in Miami Beach, Dr. A. R. Hollender will continue to limit his practice to eye, ear, nose and throat by appointment during afternoon hours, at the Lincoln-Drexel Building, Lincoln Road at Drexel Avenue. We are fairly sure that he will not object to a strenuous season of referred patients.

Pacific Physical Therapy Association

The regular December Meeting of the Pacific Physical Therapy Association was held December 21, in the Los Angeles County Medical Association Building, Los Angeles, and the following program presented.

1. "The Use of Ultraviolet Radiation".— *Albert L. Hill,* M.D. 2. "Demonstration of Testing Ultraviolet Apparatus" — *Robert C. Burt,* Ph.D. 3 Case Reports "Heliotherapy in Tuberculosis of Bone."

American Physiotherapy Association Announces Closing Date for Irregular Applicants

The Education Committee of the American Physiotherapy Association wishes to announce that examinations for the acceptance of irregularly trained applicants for membership in the American Physiotherapy Association are being discontinued in 1939. Any individual whose training is irregular, that is, who cannot present graduation from an accredited school, but whose training and experience may be considered to be the equivalent, may submit application for membership by examination to the executive committee of the American Physiotherapy Association not later than June 1, 1939. No application for examination will be considered after that date. The date of the final examination for membership will be announced later.

Section on Physical Therapy Medical Society County of Kings

A meeting of the Section on Physical Therapy of the Medical Society of County of Kings will be held on Thursday, January 12, at which the following program will be presented:

1. Inaugural Address: Physical Therapy, Present Problems—*H. Tevel Zankel,* M.D. Discussion opened by Madge C. L. McGuinness, Secretary New York Physical Therapy Society.

2. Recent Progress in Physical Medicine—*Richard Kovács,* M.D., Director of Physical Therapy, New York Polyclinic Medical School and Hospital.

No Substitute for Insulin in Diabetes

Sovereign remedy for the treatment of diabetes is insulin, the chemical produced by a group of cells in the pancreas called the islands of Langerhans.

The dramatic story of the discovery of insulin and of the consequent rescue of thousands of patients from both death and a miserable starved existence that made death a welcome release has been told and retold.

Yet stories of insulin substitutes, which can be swallowed instead of injected hypodermically, keep cropping up and arousing hope that all diabetics can keep well without the bother of needle and syringe.

In view of these stories, and to emphasize the fact that so far insulin substitutes to be taken by mouth are only in the hoped-for stage, it might be well to summarize a discussion of the subject by Dr. Hans Jensen, of the Johns Hopkins University, in his recently published book, *Insulin* (Commonwealth Fund).

Dr. Jensen says that at present there is no substance which is non-poisonous and which can be given by mouth as a substitute for insulin in the treatment of diabetes. A number of substances, he points out, have been found which reduce the amount of sugar in the blood and which when given to patients with mild diabetes have caused a decrease in the sugar in the urine. Yet there are objections to each of them which have prevented their being universally accepted for treatment of diabetes.

The crucial test which an insulin substitute must pass, before being used for treating patients, Dr.

Jensen says, is its ability to prevent symptoms of diabetes in animals from which the entire pancreas has been removed. Insulin itself does this.

These remarks on insulin substitutes do not refer to the new, so-called "slow action" insulins, which are prepared from insulin itself but altered so as to prolong the effect of the insulin. — *Science News Letter.*

Local Anesthetic Treatment Helps Arthritis Sufferers

Crippled, pain-racked arthritis sufferers may be freed of pain and helped to return to work and normal lives with the aid of local anesthetics, Dr. Otto Steinbrocker of Bellevue Hospital, New York, reported to the Congress of Anesthetists.

The treatment consists of injections of procaine, local pain-relieving agent akin to cocaine. The procaine is used in an oily solution, which makes the effect last longer. It is injected either into the painful areas or into the nerves alongside of the spine, which supply the painful joints.

The treatment is not a cure for arthritis, Dr. Steinbrocker emphasized, because it does not reach the underlying cause of the arthritis. It is palliative treatment, but the relief from pain is more than temporary and because the patient is free of pain, he is able, by massage and graded exercise to get back the use of his hands, legs or other affected parts.

If the treatment is started early, deformities can be prevented, Dr. Steinbrocker said, because these deformities are largely due to contraction of muscles to prevent pain on motion.

Dr. Steinbrocker has used the method to treat 134 patients but has only been able to trace 19 of these for learning final results. Of these, 17 were adequately or completely relieved from four months to two and one-half years after treatment.

The treatment is especially useful for acute conditions such as sprains. It shortens the time the patient must be laid up after a sprained ankle, for instance, by about two-thirds.

Scientists (Nobel Prize Winners, Academicians, College Presidents) Issue Manifesto

Counting among its 1,284 signers three Nobel prize winners, 64 members of the National Academy of Sciences and 85 college presidents, a ringing denunciation of Nazi and Fascist attacks on scientific freedom was issued by a committee of distinguished American men of science.

"We publicly condemn the Fascist position toward science . . . . In the present historical epoch democracy alone can preserve intellectual freedom," the manifesto states.

Citing ruthless Nazi persecution of scientists — 1600 teachers and scientists had been driven from their posts by the fall of 1936 — the manifesto asserts that "any attack upon freedom of thought in one sphere, even as non-political a sphere as theoretical physics, is in effect an attack on democracy itself."

Persecution of Jews and "racial" theories of science, publication of one of which furnishes the occasion for this document, are condemned in no uncertain terms. "The racial theories which they (the Fascists) advocate have been demolished time and again."

The three Nobel prize winners who are among the signers are Dr. Irving Langmuir, associate director of the General Electric Research Laboratory and chemistry prize winner in 1932; Prof. Robert A. Millikan, director of the Norman Bridge Laboratory of Physics, California Institute of Technology and 1923 physics award recipient; and Prof. Harold C. Urey, Columbia University physical chemist honored with the 1934 chemistry prize for the discovery of heavy hydrogen.

The signers, who represent 167 universities and research institutes throughout the country, pledge themselves to bend their efforts to prevent themselves or America from suffering a similar fate.

The sponsoring committee and the list of signers itself are studded with the names of the noted figures of American science, including many present and former presidents of leading scientific societies. Among the signers and a member of the sponsoring committee is Prof. Wesley C. Mitchell, Columbia University economist who is president of the American Association for the Advancement of Science.

Prof. Franz Boas, former president of the AAAS and the dean of American anthropologists, is a member of the sponsoring committee, as is Prof. Urey. Others on the committee are Prof. Karl M. Bowman of New York University and director of the division of psychiatry of the New York City Department of Hospitals; Dr. John P. Peters of Yale University and secretary of the Committee of Physicians which has been battling the American Medical Association on behalf of group medical care. Dr. Henry E. Sigerist, director of Johns Hopkins University's Institute of the History of Medicine; Prof. D. J. Struik, Massachusetts Institute of Technology, mathematician and editor of "Sciences and Society"; and Dr. Milton C. Winternitz, professor of pathology and former dean of the Yale Medical School.

Besides those named above, some of the prominent signers include Dr. Karl T. Compton, president of the Massachusetts Institute of Technology; Prof. Anton J. Carlson, University of Chicago physiologist; Prof. Clark Wissler, Yale University anthropologist and curator-in-chief of the department of anthropology at the American Museum of Natural History; Prof. Edwin G. Conklin of Princeton, past president of the AAAS and president of Science Service; and Prof. Walter B. Cannon of Harvard, co-chairman of the Medical Bureau and North American Committee to Aid Spanish Democracy. — *Science News Letter.*

Surgeons Attack Epilepsy

Cure of epilepsy by surgical operation on the brain was reported to the American College of Surgeons by Dr. E. Jefferson Browder of the Brooklyn, N. Y., Hospital. Sixteen out of 40 patients were cured by this operation which Dr. Browder demonstrated. Another 12 were improved, and 12 were unimproved.

The figures may not sound impressive but surgeons pointed out that surgeons have never been able to do anything for epilepsy in the past and that consequently this work and similar work by a few other surgeons elsewhere is a new and promising approach to the age-old problem of this ailment.

The operation is performed only on patients between 18 and 45 years of age and on those in this age group whose fits show some starting point such as movement of a thumb or hand. This starting point gives the surgeon an idea of which part of the brain may be diseased and causing epileptic fits. The exact area is determined by the patient's response to an electric current passed into the brain along a fine wire probe. Then an inch or two of brain in this region is cut out.—*Science News Letter.*

League of Nations Sets Standards for Drugs

The League of Nations may not be able to stem the "rule of might" disease that is creeping over the world, but it continues to have scientific appendages that play important roles in the lives of the peoples of various nations.

Antitoxins, sera, drugs, vitamins and six hormones, about 30 useful substances the activity of which can be measured only through use of laboratory animals, are standardized through international action fostered by the League of Nations Organization.

Curiously enough,it was war-time experience that played a leading role in convincing that national standards are not enough.

"Many deaths could have been averted," an official report says, "if the sera used during the war had been assayed in relation to a single standard. Doctors would not have been betrayed by the unitage given on foreign ampoules into injesting quantities of serum which they had good reason to regard as sufficient, but which were in fact inadequate, since the assay had been effected in terms of a unit of lesser potency than that to which they were accustomed."

Because drugs and biological products are exported and imported in peace times as well, it would be easier for manufacturers and safer for physicians and patients if uniform, international standards were used. And without standardization, how can therapeutic results on two sides of a frontier be compared?

It is not surprising that as early as 1921 the League's Health Committee called an international conference on this problem. Keeping pace with scientific progress, the sex hormones are the latest class of substances for which standards are set. Written standards are not enough; national laboratories in Copenhagen and London keep and distribute international standard preparations on behalf of the League Health Organization.

Diphtheria, tetanus, staphylococcus, and gas-gangrene antitoxins, anti-dysentery and anti-pneumococcus sera, insulin, pituitary extract, vitamins A, B, C and D, digitalis, salvarsan, neosalvarsan, and sulfarsphenamine are among the substances standardized. — *Science News Letter.*

Eye Is Electric Generator, Current Tiny But Measurable

"Electric glances," favorite phrase of old-time romantic novelists, is closer to literal fact than they ever guessed. For the human eye is an actual electrical generator, Prof. Walter R. Miles of Yale Medical School told the National Academy of Sciences, at the opening of their autumn meeting on the campus of the University of North Carolina.

The front part of the eye, Prof. Miles said, is electrically positive and the back part, where the retina is, has the opposite or negative charge. These differences in potential can be detected and measured by sticking thin pieces of metal foil on the skin at either side of the eye and attaching the wires to sufficiently delicate voltmeters. When the eye is held still, the instrument indicates steady voltage. As soon as you turn or roll your eye, you bring differently charged areas under the little electrodes, and the changes in the current show themselves on the dial.

Differences in potential measured during a wide turning of the eyeball, range from .0002 to .003 volt for each eye. The amount of light falling on the eye at the time of measurement makes only a small difference in the result. One eye may differ markedly from its mate, just as people differ among themselves. Minor visual defects seem to make little difference.

That the eyeball itself, and not the surrounding muscle, is the source of the current was demonstrated when the tests were checked on persons who had lost one eye. If the eyeball is not there no current is generated, regardless of whether the socket is left empty or filled with a glass eye.

Cotton Under Microscope

Cotton, on which so much depends in the South and in the nation, was put under the ultra-microscope by Prof. Donald B. Anderson of North Carolina State College. The wall of the cotton fiber, he said, is composed of exceedingly small thread-like strands of cellulose that branch and interlace freely with each other, forming a close-meshed network.

In the oldest layer of the cell wall the cellulose strands lie in flat, close spirals, but in the parts formed later the strands wind in steep spirals. It is possible to control the rate at which the cellulose is laid down by controlling the environment. This may mean eventually a control of the quality and kind of cotton by suitable adjustments of the conditions under which it is grown, especially as regards temperature and light.

Increase Seed Size

Double the number of chromosomes in the cells of a plant and it will yield bigger seeds and show other changes in the direction of general giantism, Drs. A. F. Blakeslee and H. E. Warmke of the Carnegie Institution of Washington told the meeting. They provoked extra-chromosome plant types into existence by treating the parents with the drug colchicine.

Other effects of extra chromosomes Dr. Blakeslee mentioned were larger flowers, increase in width, thickness, and greenness of leaves, shorter, thicker fruits, and larger stomata or breathing-pores. To-

gether with Prof. E. W. Sinnott of Columbia University, Dr. Blakeslee also found that increase in number of chromosomes in squashes and gourds caused their fruits to become shorter and wider than the parent type.

Barytron Behavior

Barytrons, which are sub-atomic particles 200 times as massive as electrons, were pointed out as responsible for sudden bursts or showers of cosmic rays, by Prof. L. W. Nordheim of Duke University. These heavy particles constitute the major part of all cosmic rays at sea level and under ground, but not in the upper atmosphere. Prof. Nordheim suggested that when a barytron passes through matter and collides with electrons that are part of the atoms in it, these electrons are knocked out of their circuits in sudden bursts, at high velocities, thus constituting the "showers."

Find Waltzing Star

A star that carries on an unending waltz through space with a dark partner that no one has ever seen was described by Drs. S. A. Mitchell and D. Reuyl of the Leander McCormick Observatory of the University of Virginia. The star is known as Ross 614.

The weaving motion of the star can be traced, the scientists reported, indicating that it is whirling round and round a massive stellar body like itself, as do all the familiar double stars in which both members are bright, but the companion here is invisible.

A somewhat similar case is that of the giant dog star, Sirius, which has a massive companion whose light is exceedingly faint. But this is the first recorded case of a companion star that is totally invisible.

The faint star known to astronomers as Wolf 424, announced a short time ago to be earth's nearest neighbor in space, was "put back in its place" by the two astronomers. They told the Academicians that there are at least thirty stars nearer to the earth than this one.

International Exchange

Science's international character is to be stressed through a new exchange of lecturers between the United States and Great Britain, arranged for in London and supported financially in the Pilgrim Trust, which was established by Edward S. Harkness, an American. The new lectureship is to be known as the Pilgrim Trust Lectureship.

In alternate years, noted British men of science, chosen by the Royal Society of London, will come to America to speak on fundamental scientific achievements and problems; and in the intervening years leading American scientists, selected by the National Academy of Sciences, will return these "courtesy visits of learning."

The series will be inaugurated on Dec. 8 of this year, when Dr. Irving Langmuir of the General Electric Company research laboratory will speak in London.

The first English lecture will be presented in Washington during the spring meeting of the National Academy of Sciences, by Sir William Bragg, president of the Royal Society. — *Science News Letter.*

Report on Spas and Health Resorts

(*Continued from page 11*)

a) The small institutions up to 100 capacity are particularly suited to provide such service because of lessened overhead expenses.

b) The large institutions may provide smaller units to furnish service at moderate costs.

The Committee considers that its task is not completed due to the incomplete returns of the questionnaires, particularly in the Middle and Far West, and the need for more careful study of the small institution.

The Committee also considers that the data obtained from this survey to date should be made available in printed form and sent to all institutions cooperating in this survey, and to any other places requesting this pamphlet.

Complete cooperation with any study or survey of the spas and health resorts which may be undertaken by any recognized medical organization is desirable.

W. S. McCLELLAN, Chairman,
C. I. SINGER,
F. H. KRUSEN,
R. KOVÁCS,
E. M. SMITH, } Not present at
H. WOLF } Committee meeting.

THE STUDENT'S LIBRARY

CLINICAL ELECTROSURGERY. By *Gustavus M. Blech*, G.S.C., G.C.G., M.D., LL.D. Formerly Professor of Clinical Surgery, Loyola University; Consulting Surgeon, Westlake Hospital; Attending Surgeon, Edgewater Hospital, etc. With chapters by *Hector Alfred Colwell*, M.B., Ph.D., L.R.C.P., M.R.C.S., etc. Lecturer in Biophysics and Radiology, Senior Assistant in Cancer Research Department, Middlesex Hospital, and *Brian Wellington Windeyer*, F.R.C.S., D.M.R.E., Radium Officer, Middlesex Hospital; Visiting Radiotherapist, North Middlesex Hospital, London, England. Cloth. Pp. 416 with 34 illustrations. Price $4.00. London, New York, Toronto: Oxford University Press, 1938.

This volume by one whose scalpel and pen have long singled him out as a contemporary above average reputation and talent, promises to become the most widely read book on electrosurgery because it has presented the principles and practice of this important procedure in a singularly comprehensive and critical fashion. The dictum that easy reading is born of painstaking writing, and that clear exposition comes from ripe experience is well exemplified in the foregoing text. To transform a subject surrounded by a formidable nomenclature into a limpid, interesting reading exposition is an achievement to be praised, but to trenchantly debunk and cleanse a procedure and yet be able to arouse despite the maze of technical discussions, warmest interest in the present and future possibilities of electrosurgery is a feat that only high literary talent and sincere conviction could attain. Indeed, the reviewer confesses to one of those rare experiences wherein a technical dissertation held his interest fast bound to the end, and felt the richer for its reading. Prepared as a clinical text, the author has maintained careful literary balance by reducing technical and theoretic considerations to the minimum essential for a working basis toward the larger exposition of its wide scope in practice. Thus the contents are divided into two main parts of six and ten chapters, under the leading titles of "General Consideration" and "Electrosurgical Operations." Noteworthy of mention because of its informative and scholarly excellence is chapter 1 by Colwell of London, which reviews the historic development of electrosurgical procedures. Among the historic wealth of data Colwell offers supportive proof of the priority of d'Arsonval's contributions on high frequency current above any other individual. The remaining five chapters of part 1 discuss electrosurgical methods from the viewpoint of equipment, indications, technic, nomenclature, and radiotherapy of neoplasms (Windeyer and Colwell). Part 2 reviews at considerable detail its operative advantages, results and management of benign and malignant diseases whether located in superficial or deep seated organs. As stated by the author in his preface, "no attempt has been made to include everything that has appeared in the literature . . . except tried methods that are likely to be utilized in actual practice." Accordingly this work provides an informative and authoritative text on electrosurgical procedures for surgeons and students that assures broadest orientation on the subject. The glossary, index and rich bibliography will be found helpful aids for specific information and broader guidance in this special branch of modern surgery.

DOCTOR BRADLEY REMEMBERS. A novel. By *Francis Brett Young*. Cloth. Pp. 522. Price, $2.75. New York: Reynal & Hitchcock, 1938.

The story of the country or family doctor despite numberless repetitions has increased in glamour, interest and romance and its retelling has been the ambition of the most talented in the literary field. Omitting geographic and temporal detail, one finds that the formula for its colorful psychologic and emotional background to have been beautifully exploited in the past. Who does not recall the *Country Doctor* of Balzac, the Doctor Winter of Conan Doyle, the Doctor William McClure of Ian McLaren, or the beautiful panegyric of Robert Louis Stevenson about the doctor? Stevenson's tribute to the profession is summarized in his observation that the doctor is "a man who had fewest of the vices and most of the virtues of our race." In loving memory, humanity has inconsistently placed its laurel wreath over the tombstones of these departed humanitarians and often as not neglected them in life.

Doctor Bradley Remembers as told by one of our talented English contemporary writers will go down in the history of literature as one of the most poignant and colorful contributions in fiction. Brett Young himself a doctor who preferred the vocation of letters to medicine creates the character of John Bradley as one steeped in the best medical tradition of the period known as the Listerian era, and describes him in a romantic canvas rich with interest, pathos and deepest significance. Out of poverty and sheer will-power a young doctor of average intellect emerges and sets up his surgery in a small town in the impoverished coal district of England. In the fifty years of self-sacrificing and sympathetic service in this community of simple but honest people, Bradley runs through the gamut of major emotions. He finds love in a wife who dies early from puerpural infection. His son is a disappointment and a tragic burden. Passionately seeking surcease from his own suffering he discovers in long labor the happy counterbalance. In colors as somber as they are heroic, the author paints a picture long to be remembered of a man with "the fewest vices and most of the virtues of our race." In the end the doctor sells his surgery to a young graduate who modernizes his practice with the latest of diathermy and other physical therapy instruments and retires with his memories to the winter of his content.

A PRACTICAL GUIDE TO MASSAGE. By *C. Irene Carpenter,* Member of the Chartered Society of Massage and Medical Gymnastics; Member of the Almeric Paget Corps, 1914-1918; Diplomée of the Chelsea College of Physical Education. With a foreword by *L. Haden Guest,* M.C., M.R.C.S., L.R.C.P., and introduction by *David Katz,* Ph.D., Professor of Psychology and Education, Högskola of Stockholm. Cloth. Pp. 127. Price $2.00. Baltimore: William Wood and Company, 1937.

This work differs in its objective from most other contributions on massotherapy in that it has attempted to stress the physiologic action of manual manipulation as a fundamental precept. Though limited in space the author has nevertheless managed to convey a clear idea of the practical and scientific basis of her thesis; that is, that each portion of the body treated is but a part of a physiologic whole, and that massage is not a panacea for all ills, but must be employed in relation to other recognized methods. The book comes recommended by a short but warm foreword by L. Haden Guest who sees in the emphasis of structural-functional unity a scientific basis for the author's exposition, and is further supported by a sympathetic introduction by Professor David Katz who at longer length explains that its scientific purpose is to emphasize that function of the smallest part is conditioned by the organism as a whole. The point of view taken by Carpenter is the interpretation of massage from a biological instead of mechanical concept. Hence it follows that due weight is given to psychologic and nervous factors, and to the physiologic influence of the tissues and textures encountered within the scope of such treatment. The text proper is divided into three parts. The first is devoted to a fairly comprehensive discussion of the physiologic reactions invoked by massage; the second, to movements of massage and their effects; the third, to typical medical problems for which massage is prescribed. Accordingly this author introduces a critical approach to a procedure which has until recently assumed a static and perhaps a non-progressive position, and is among the few of the newer contributions that insist upon a scientific explanation for the manual mechanics and technics utilized in its practice. The complete absence of any bibliographic references, however, tends to reduce the text to the denominator of a manual for nurses and technicians rather than one which might have interested the more specialized student or physician in search for detailed, fundamental knowledge. As a practical guide it fulfills all the promise of such a restricted exposition.

A SYNOPSIS OF PHYSIOLOGY. By *A. Rendle Short,* B.S., M.P., F.R.C.S., Professor of Surgery, University of Bristol, and *C. L. G. Pratt,* M.A., M.S., M.D., Demonstrator in Physiology, University of Oxford. Cloth. Pp. 325. Price $3.50. Baltimore: William Wood and Company, 1938.

The frequency with which the profession now refers to the fundamentals and the advances in physiology due to the better known relationship between clinical practice and biologic reactions, has made greater demands for contributions that are brief, concise and authoritative. Such a work in synopsis form provides the very essentials necessary for progressive and busy practitioners as well as for brush-up study for students and lecturers in their related interests. The present edition has been brought down to date and presents a full but compressed picture of the latest contributions on the subject. The volume shows the benefit of both revisions and numerous additions which makes it a reliable summary of the advances in human physiology. The format is in skeletal style intermixed with large, small and boldface type as a method of emphasizing and directing attention to the subjects under consideration. The book is pocket-sized and is divided into 24 chapters and an index. No better example of brevity plus maximum information is extant on the subject.

ESSENTIALS OF PATHOLOGY. By *Lawrence W. Smith,* M.D., Professor of Pathology, Temple University School of Medicine; Formerly Assistant Professor of Pathology, Harvard Medical College; and Associate Professor of Pathology, Cornell University Medical School; and *Edwin S. Gault,* M.D., Associate Professor of Pathology, Temple University School of Medicine. With a foreword by *James Ewing,* M.D., Memorial Hospital, New York City. Cloth. Pp. 886 with 680 illustrations and colored plates. Price $9.00. New York and London: D. Appleton-Century Company, 1938.

In this textbook an entirely new approach to the subject of pathology has been introduced. This according to the authors, has been necessary because of the extreme crowding in the present day medical curriculum, which allows time for learning only essential pathologic principles. Smith and Gault have designed their book to incorporate all the basic data and emphasize only the most accepted theories. Carrying this plan to a didactic practical conclusion, they have purposely excluded any bibliographic references in their text because few medical students have the opportunity to examine original sources, or can when need calls, obtain these from either their instructor or from specialized publications. Bound-in blank pages are provided at the end of each chapter for notes, comments and additional orientation. Further innovations in this work include the extensive use of case histories and special illustrations. These serve the dual purpose of supplementing the written material and giving a closer correlation of the subject matter to actual clinical work. Surprising as it may seem, the instruction by case histories though apparently necessary in clinical training, has been neglected by authors of pathologic textbooks. As a method of study it should prove of similar advantage for the closer approximation of clinical and preclinical work. To students and teachers this text will acquire still greater practical significance because the prolific photomicrographs and illustrated material make this an admirable adjunct to laboratory and lecture work.

THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY: A complete Dictionary of the terms used in Medicine, Surgery, Dentistry, Pharmacy, Chemistry, Nursing, Veterinary Science, Biology, Medical Biography, etc. By *W. A. Newman Dorland*, A.M., M.D., F.A.C.S., Lieut.-Colonel, M.R.C., U. S. Army; Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association; Editor of the "American Pocket Medical Dictionary". With the Collaboration of *E. C. L. Miller*, M.D., Medical College of Virginia. Eighteenth Edition, Revised and Enlarged. 1607 pages with 942 illustrations, including 283 portraits. Flexible and Stiff Binding. Price, Plain, $7.00 net. Thumb Indexed, $7.50 net. Philadelphia and London: W. B. Saunders Company, 1938.

The popularity and practical need for this illustrated medical dictionary is demonstrated by the fact that it has required eighteen editions to keep pace with the profession's demands for a volume both convenient in size, authoritative in information, and down to date in content. To keep it abreast with the progress in medical and allied fields, the present volume has incorporated and defined over 3000 new words and terms, and as a result, the text shows an increase of over 60 pages. These additions are to be found in the field or sections related to clinical medicine, medical chemistry, dentistry, endocrinology, immunology and pathology. For instance, the terminology of biopsychology has been greatly enriched and more than 100 tests are described. For accomplishment of this difficult task it has had the cooperation of the editorial staff of the American Medical Association under the direction of Dr. Morris Fishbein. Accordingly it can readily be appreciated that the work as a whole has been materially benefited by a critical editorial staff which has endeavored to maintain the high standard set for it as a useful and practical guide to practitioners and students of medicine and the allied fields.

HUMAN PATHOLOGY, A TEXTBOOK. By *Howard T. Karsner*, M.D., Professor of Pathology, Western Reserve University, Cleveland, Ohio. With an introduction by *Simon Flexner*, M.D. Fifth Edition, Revised. Cloth. Pp. 1013 with 18 illustrations in color and 443 in black and white. Price, $10.00. Philadelphia and London: J. B. Lippincott Company, 1938.

The fifth edition of Karsner's well known textbook shows studious revisions in the form of many deletions, alterations and additions which go far to advance the scope of his work. Of the new references 250 have been added and many old ones removed. Discussions of pathologic pigmentations have included the latest material on pulmonary silicosis. Fatty metamorphosis is presented in a new light, and the subjects of amyloidosis and circulatory disturbances are discussed from the latest findings. In addition Karsner has replaced out-dated illustrations and amplified the text by the inclusion of six new plates on various subjects. Undoubtedly the present edition will be warmly acclaimed by students of pathology because it successfully presents all sides of debatable accepted and advanced questions current in this field. Much of the dogmatism therefore that prevails in general texts on the subject has been eliminated. By this approach together with the author's authoritative experience a lucid and comprehensive exposition has been provided in gross and histologic pathology as in the underlying theoretical problems. Some criticism may be made so far as the quality of illustrations are concerned, for though the book admirably presents all the basic information in written form, more could be desired of that important branch of visual information — good pictures, which are more eloquent than words and more meaningful than pages of text matter. However, this factor is of only minor importance and only minimizes but does not materially detract from the actual value of this contribution. The fact that this work now enters into its fifth edition and is highly spoken for by Flexner in his Introduction, is an index that it has long been accepted and recommended as a reliable text for students and physicians.

FROM CAPTIVITY TO FAME, or the LIFE OF GEORGE WASHINGTON CARVER. By *Raleigh H. Merritt*. Cloth. Pp. 230. Price, $2.00. Boston: Meador Publishing Company, 1938.

Although the author of this narrative of an embodied epic disclaims any special ability as a biographer or any attempt to present a detailed account of the life of the famous seventy-four year old negro scientist, he has in 131 pages presented an earnest and readable sketch of Dr. Carver, the noted agricultural chemist. The life of this unusual and gifted man is at once a tragedy and an inspiration, an heroic theme of birth as the child of slaves, left as a boy penniless and without kith or kin, to learn the elements of reading and writing and to work his way through agricultural colleges where he early revealed a genius for pioneer research in agricultural chemistry and allied sciences. Finally placed in charge of a special laboratory and grounds of Tuskegee College, founded by Booker T. Washington, his whole life became a devotion to research, which has proved as practically useful as it is inspirational to all who have an ambition to add to the sum total of human happiness. Dr. Carver will be remembered as the man who demonstrated the nutritive value of peanuts from which he extracted not only the oil but milk-like products for which he secured special legislation by the war-time Senate for its protection. Apart from this he has extended his investigations to plants and mycologic specimens, and has shown considerable talent as a painter. In spite of the unfortunately too common prejudices among our college youths in the matter of race, Dr. Carver gained the friendship of his teachers and the respect of many fellow students, who realized his inherent qualities and his almost sacerdotal devotion to science. The story may be summed up as one of the best arguments against the arrogant and false claims of certain holier-and-better-than-thou racial purists. Of the remaining pages of the book approximately 100 are devoted to countless dietetic and other formulae, in which the manifold uses of peanuts are predominant. The book contains 22 photo-

graphic reproductions illustrating the subject of the biography, his work, laboratories and the like. It is a small book, but well worth careful perusal.

THE OCCUPATIONAL TREATMENT OF MENTAL ILLNESS. By *John Iverson Russell*, M.B., Ch.B., F.R.F.P.S., (Glas.) D.P.M., Medical Superintendent, North Riding Mental Hospital; Visitor, Mental Deficiency Institutions, N.R., Yorkshire; Examiner in Occupational Therapy to the Royal Medico-Psychological Association; Examiner to the Association of Occupational Therapists. Foreword by *William Rees-Thomas*, M.D., B.S., F.R.C.P. (Lond.), Dipl. Psych. Med. (Camb.) Senior Medical Commissioner, Board of Control. Cloth. Pp. 231 with 41 illustrations. Price, $2.50. Baltimore: William Wood & Company, 1938.

William Rees-Thomas, in his Foreword, states that this is the first contribution in England entirely devoted to Occupational Therapy. Though it was written primarily for use of the occupational therapist and the nursing profession, it also has special value for physicians contemplating its adjuvant possibilities. The text as a whole discusses the theoretical and practical sides of occupational therapy. It is pointed out that occupational therapy is not merely to be used as a pastime, but as a deliberate means of directing the patient's attention to material objects, to prevent the mentally disturbed individual from seeking refuge in morbid introspection. It is necessary to know which crafts are of therapeutic value to different types so as not to overestimate their limitations. Russell stresses the fact that occupational therapy should be directed and supervised by a physician, who must consider such factors as the personality type of the individual, the classification of the patient, the concentration value required, and the necessary precautions. In the organization of an occupational therapy department the training and part of the personnel must be considered as well as the grouping and classification of the patients. The author also takes up a habit training program, physical training and recreation as games, dancing and indoor sports. For the practical consideration of occupational therapy the author discusses design and various crafts, such as woodwork, basketry, brush making, book-binding, the use of plaster, and miscellaneous crafts, giving many helpful suggestions as to grades and therapeutic value of each. It must be remembered that the therapeutic aspect of the work consists in making the patient think well of himself. Russell is thoroughly convinced that idleness is a positive evil and that it is the cause rather than the effect of social, moral and intellectual deterioration of those suffering from mental illness. Therefore, occupational therapy is as necessary as any other treatment of a mental patient and should be given of suitable quality and quantity. This book is excellent for anyone working with mental cases in convincing them of the importance of occupation and giving helpful suggestions for occupations.

A HANDBOOK OF ROENTGEN AND RADIUM THERAPY. By *A. J. Delario*, B.A., M.D., Radiologist, St. Joseph Hospital, Paterson, N. J., and Community Hospital, Montclair, N. J. Cloth. Pp. 362 with illustrations, numerous engravings, graphs and tables. Price, $8.00. Philadelphia: F. A. Davis Company, 1938.

The author prefaces his thesis by modestly professing no originality so far as the contents of the book is concerned, except that in the course of his studies on roentgen and radium rays he had attempted to collect all possible information by means of excellent books and recent literature, investigation of hospitals to observe their methods of practice, and the assembling of this information in a notebook to which was added charts and graphs of his own making. Pleasing it is therefore to call attention that out of this modest beginning Delario has built an impressive as well as an authoritative text that reviews the subject of radiotherapy in a practical and detailed fashion from both a theoretic and clinical viewpoint. The fact that the volume incorporates nearly 500 references is proof that the author delved deep into the literature and selected his reading material from wide sources. In content the work is divided into three sections. The first presents theories, principles, technics, methods and dosage. It discusses the origin and production of roentgen and radium waves, the methods by which their wavelength is measured, their biologic and physical characteristics, therapeutic dosage in relation to the erythema factor and the rate of tissue recovery following irradiation by x- and radium rays. Of the fifteen chapters that make up this section, four are devoted to discussions of therapeutic dosage and diseases amenable to radiation therapy. The second part deals with figures and tables in graphic form for a more concise orientation of the theoretic and practical value of roentgen and radium waves. This includes information on the amount of radiation to be delivered and controlled through the factors of kilowattage, filtration, milliamperage, skin focal distance, and the like. Dosage calculation is made the easier by tables on radium, as well as specific knowledge on methods of calculating size form, filtration and applicators for radium treatment. The third part reviews the end results obtained with roentgen and radium therapy. The author has adhered to a style in which long descriptions are replaced by the brevity of tabulated facts. Under such a style there is brought forth an impressive array of comparative knowledge of the significant results obtained by surgery, roentgen and radium therapy alone or in combination in the treatment of benign and malignant neoplasms. The rich bibliography and detailed index concludes a work which deserves wide reading as a practical and authoritative handbook on radiotherapy for students and specialists.

INTERNATIONAL ABSTRACTS

Effect of Artificial Fever and Specific Antiserum on Organisms in Type III Pneumococcus Meningitis. Morris F. Shaffer; John F. Enders, and James Wilson.

J. Clin. Invest. **17**:133 (March) 1938.

The effect of elevating the body temperature to 105 F. or higher for periods of several hours on the bacterial infection of the spinal fluid has been determined in two patients with type III pneumococcus meningitis. Under these conditions there occurred a marked reduction in the number of viable pneumococci and the quantity of free soluble type-specific antigen present. In neither case was sterility of the fluid attained. In two patients the effect of treatment by intrathecal injection of potent antipneumococcus type III rabbit serum was analyzed. Temporary sterility of the spinal fluid followed rapidly in each case, concomittantly with the disappearance of the soluble antigen. Eventually, however, the pneumococci reappeared. The causes of failure to obtain permanent sterilization of the subarachnoid space are discussed.

The combined treatment, consisting of artificial fever through the application of radiant heat, and injection of rabbit antiserum with artificial fever appeared to produce the best result as estimated by the conditions obtained in the cerebrospinal fluid, although recovery of the single patient so treated did not ensue.

Fever Therapy Plus Additional Local Heating In Treatment of Gonorrhea. Frank H. Krusen, Lawrence M. Randall, and Louis G. Stuhler.

Am. J. Syph., Gonor. & Ven. Dis. **22**:185 (March) 1938.

Fever by physical means is of decided value in the treatment of gonorrhea, particularly when there is a well organized team of workers using a satisfactory device. The tendency has been to lessen the number of sessions of fever therapy by prolonging the duration of each session, including the more acute forms of gonorrhea. Oxygen inhalations during treatment have not brought about satisfactory results with lower degrees of fever; however, a high fever plus oxygen inhalations seem to be slightly more effective than does high fever alone. In cases of women who have pelvic inflammatory disease which proves refractory to fever therapy, the addition of local pelvic heating in conjunction with fever therapy has produced most encouraging results. With proper preparation and follow-up treatment, single 10-hour sessions of fever therapy at 41.5 C. (106.7F.) will produce negative cultures in a high percentage of cases of gonorrhea. It is believed that a single long session of fever therapy combined in suitable cases with additional local heating offers the most satisfactory method of treating gonorrheal urethritis, cervicitis, pelvic inflammatory disease, and certain complications of the infection.

Hospital Air Conditioning. C. P. Yaglou.

J. A. M. A. **110**:2003 (June 11) 1938.

While many diseases have been treated with various degrees of success, the greatest field appears to be in acute and chronic gonorrhea, since the specific pathogenic organisms involved can be killed by heat within the limits of tolerance of man (from 105 to 107 F.). Lately, fever therapy has appeared to be of value in the management of painful neuritic states in which heretofore no single procedure has given satisfactory relief. Bennett and Cash present extensive clinical evidence on the relief of painful neuritic meningitic and radicular states with systemic fever at 103-105 F. in treatments of two to three hours each, from two to six treatments altogether.

In the past three years, several heat cabinets have appeared with some improvements. Probably the most important is the substitution for hot dry air of nearly saturated air at a comparatively low temperature. In this way burns of the skin are eliminated, the loss of water and chloride may be less, and the room in which the hypertherm is located is not heated as much as when hot dry air is used. It is appreciated that with a relative humidity of 30 per cent it would take too long to raise the body temperature 6 degrees F. (from 99 to 105) without resorting to excessively high air temperature. With 60 per cent relative humidity and air movement of 400 feet per minute over the body, a temperature of about 120 F. will raise the body temperature 6 degrees in one hour, whereas with saturated air the cabinet temperature need only be from 106 to 107 F. These values will vary in different individuals and in different diseases. Few data are available on the combinations of temperature and humidity required to maintain the body at various fever temperatures after initial heating. With saturated air a temperature of about 100 F. appears to be sufficient to keep the body at 105. Extensive work in fever therapy is continuing on a wide variety of pathologic conditions. While this form of therapy is rapidly gaining wide recognition, its application "should remain strictly a hospital procedure surrounded with the safeguards commonly employed in a major operation and under the direction of skilled physicians."

Electrosurgery in Proctology. R. V. Gorsch.

Am. J. Surg. **40**:436 (May) 1938.

Adenoma, polyps, papilloma, villous tumor include a number of so-called benign tumors, which,

however, possess the anlages for ultimate malignancy, particularly in adults. On this account they are of particular interest and importance and their prompt and complete removal is highly desirable. The vast majority of these tumors lend themselves to electrosurgical removal, with the proper type of cutting current with the electric snare. Coagulation is sometimes an additional measure of value in this technic; it has been referred to as circumvallation, a procedure which produces a ring of coagulation in the mucosa around the snared off stamp. This may destroy tumor cells already beyond the confines of the malignant base and interferes further with the circulation of the stump, assuring as much destruction as is possible without actual excision. The mucosa alone should be coagulated. Perforation is possible.

In some cases, the entire tumor may be destroyed by electrocoagulation and allowed to slough off. This may be the method of choice in particular vascular tumors, in those with broad pedicles, or in unfavorable locations.

In malignancy, granulomatous lesions, dermoids, and the like the cutting current combined with clamp coagulation or direct vessel coagulation has definitely widened the scope of cancer surgery in proctology, particularly in debilitated and elderly patients in whom the diminished hemorrhage is of importance. The coagulum on extensive wounds seems likewise to lessen the loss of fluids, the absorption of toxic wound products and to decrease post-operative pain. On the other hand it is not believed that the electrosurgical technic has any decided advantage in ths usual combined perineoabdominal excision of the rectum or sigmoid; certainly not in the abdominal technic.

Low Intensity Short Wave Therapy–Some Clinical Aspects. P. P. Dalton.

Brit. J. Phys. Med. 1:48 (Feb.) 1938.

Some clinicians have reported that they are unable to obtain any results at all from low intensity short wave therapy. It has been used by the author in a number of cases with such remarkable results that one cannot help thinking that other workers must have employed it in unsuitable cases. These waves have a depressant effect on unhealthy nerve-muscle preparations, so that one may expect some effect on the spastic types of paralysis. At Vienna the author learned that it has been used with success by Dr. Weissenberg in such cases.

Importance of Immobilization and Posture in Treatment of Acute Infections of Extremities. Owen H. Wangensteen.

Minnesota Med. 2:225 (April) 1938.

Elevation is a valuable addition to the treatment of acute infections, particularly when the inflammation affects the soft tissues. Increased relief of pain and quicker reduction of swelling are noted. Institution of rigid immobilization in a body cast with the extremity in marked elevation occasionally rendered incision for the evacuation of exudate in soft tissues superfluous. Not uncommonly a single short incision sufficed in instances where one had anticipated more extensive intervention. In paronychias without hazard of dissemination of the infection continuous steep elevation of the arm and hand on a suitable bedside splint has been carried out with evidence of subsidence of the infection. The application of heat and employment of Bier's hyperemia are measures which increase swelling, objectives which are to be avoided in the treatment of acute pyogenic infections.

Sinuses as Points of Focal Infection and Treatment of Sinusitis. William Fletcher.

Laryngoscope 48:17 (Feb.) 1938.

Steam, together with the vapor of such substances as camphor and menthol, may be inhaled. The fact that the patient feels more comfortable is the chief value of this method. Hot wet applications over the face or a hot water bottle or electric pad placed over the infected sinus give comfort. The infra-red lamp is the most effective method of applying heat to the sinuses. There is reason to believe that the infra-red rays penetrate the sinus and influence its circulation, thus being of greater aid than any other safe, simple treatment of our command. For treating infants and small children this is almost the only available and the most valuable treatment known.

The infra-red lamp should be used as hot as the patient will permit. The time of treatment is usually 20-30 minutes. In severe cases the treatment should be repeated about once in 12 hours, or about once each day. Severe cases in the home should be treated about once every six hours. The Kromayer lamp is very helpful in relieving congestion of the nasal mucosa and in aiding drainage. It has little or no value within the sinus itself.

Effect of Short Wave Therapy On Guinea Pig Testis. Seymour F. Wilhelm and Albert M. Schwartz.

J. Urol. 40:335 (Aug.) 1938.

The testis of 18 guinea pigs were exposed to a single short wave radiation of 20 to 60 minutes duration. The testes were excised and examined at intervals of 3 hours to 80 days after exposure. One of the guinea pigs died of hyperpyrexia. Gross examination of its testes revealed only congestion of the superficial blood vessels. Microscopically there was a diminution in the number of spermatozoa. The germinal epithelium and interstitial tissues, however, appeared normal. The remaining 34 testes showed no evidence of pathological change on gross and microscopical examination. The testes of 2 guinea pigs were excised at intervals of 1 to 10 days after the last exposure. No evidence of pathological change was observed on gross and microscopical examination. Evans and Burr have shown experimentally that a loss of fertilizing power may occur despite the absence of morphological changes in the seminal fluid. Rats on a vitamin E free diet were sterile although an abundance of motile nor-

mal spermatozoa had been recovered in the bouchon vaginale. It would, therefore, be incautious to conclude from our experiments that short wave radiation is innocuous. Physiological changes lessening fertility may have occurred in the absence of demonstrable morphological lesions.

Little Used But Highly Effective Physiotherapy (Hydrotherapy in Dermatitis Venenata). Robert H. Leece.

M. Bull. Vet. Admin. **14**:362 (April) 1938.

Little used but highly effective is hydrotherapy for very extensive dermatitis venenata. The most common causative factor for this dermatitis is contact with poison ivy (rhus toxicodendron) or poison oak (rhus diversiloba). In cases where there is very extensive areas of the skin involved, especially that of the external genitalia, body and extremities, the giving of a continuous, neutral temperature bath, for 4 to 8 hours or more per day, will result in complete cure, usually in 3 days. This treatment originated in a rural community where those who came in contact with the poisonous plants would lie in the waters of a near by lake for several hours a day for 2 to 3 days, and thus effect a cure in less time than their family physician could by the use of external applications.

Relative Rise in Temperature of Tissues Heated in High Frequency Field. H. J. Taylor.

Brit. J. Phys. Med. **1**:82 (March) 1938.

In comparing the relative rise in temperature in the high frequency field of various tissues, it was found that with the wavelengths used (6 to 3.5m.) fat is always heated to a far higher temperature than other tissues. With decreasing wavelengths, however, the relative heating of fat and other tissues becomes less in intensity.

Progress In Otolaryngology. George B. Wood.

Arch. Otolaryng. **27**:476 (April) 1938.

For the curative treatment of laryngeal tuberculosis electrocauterization is by far the most important method. There is apparently some variance of opinion as to the indications, and a number of authors use this instrument only as a last resort. Ruedi avoids operative intervention when there is no pain, when the lesion is more or less localized or when the pulmonary condition is still active. In such cases he suggests roentgen therapy or the intravenous use of solganol B (the disodium salt of 4-sulfomethylamino-2-auromercaptobenzene-1-sulfonic acid). He advises against general treatment with an arc lamp. He is apparently energetic in his use of the cautery, having devised a spiral platinum burner of various shapes and sizes, which he employs at almost white heat.

Blegvad prefers ultraviolet radiation with a quartz lamp for the conservative treatment of patients with laryngeal tuberculosis. However, if improvement is not shown within a few months, operative work by the indirect method is indicated. At the Finsen Institute between 1922 and 1936 there were performed 401 excisions, 527 galvanocauterizations, 40 amputations of the epiglottis, 127 injections of alcohol and 49 resections of the superior laryngeal nerve. By these procedures 29.1 per cent of the patients were cured, 10.2 per cent improved and 60.7 unimproved.

Kowler and d'Halluin state that the favorable results of heliotherapy have been exaggerated. Even when ultraviolet rays are combined with other types of rays, they say that the ultraviolet has slight curative action. They express the hope that future research will provide more knowledge concerning the action of the ultraviolet as it is found in the atmosphere, because at present there is little evidence to show that this is of much importance in the treatment of laryngeal tuberculosis.

Xeroderma Pigmentosum With Mental Deficiency. Alexander G. Silberstein.

Am. J. Dis. Chil. **55**:786 (April) 1938.

Xeroderma pigmentosum is a comparatively rare disease which was first described by Kaposi. It is of unknown etiology and probably congenital. Consanguinity of the parents is said to be a predisposing factor. The onset of the disease occurs characteristically during the first year of life. The skin apparently is hypersensitive to light rays of wavelengths between 280 and 210 millimicrons. The pathologic condition of the skin shows three stages: erythroderma, with mottling and hyperemia, slight puffiness and roughening, pigmentation, with freckle formation, scaling and the formation of transient cutaneous atrophy and late contractures of the eyelids, nose and mouth. The course is progressive but usually shows periods of quiescence. The duration of life is, as a rule, not beyond twenty-one years. Death generally results from inanition.

Treatment of Detachment of Retina With Thermophore. H. Maxwell Langdon.

Am. J. Ophth. **21**:525 (May) 1938.

In November, 1934, Langdon reported a case of detachment of the lower portion of the retina. The patient had been operated on two months before: a sclerotomy for the purpose of draining the subretinal fluid was followed with applications of Shahan's thermophore, using a 2 mm. tip, at a temperature of 165 F. The retina was in good position when the case was reported. Shahan reported a case at a meeting of the St. Louis Ophthalmic Society. His report has not yet been published in full, but he reverses the procedure which the author used, applying the heat first and performing the sclerotomy afterwards in order to maintain intraocular tension; also because he and Dr. L. T. Post have found that 165 degrees of heat with a thermophore applied to the sclera destroyed the retina at the site of the application in experimental animals in which there was no detachment. He believes, therefore, that it is better to apply the heat while the retina is held away from the choroid by the

sub-retinal fluid. The author never had any trouble with the lowering of the intraocular tension by the sclerotomy punctures, and it is difficult to see how a certain amount of damage to the retina can be avoided if we are going to have exudate enough thrown out to produce adhesion to the choroid.

Gonorrhea In Male. John R. Caulk.

J. Missouri M. A. **25**:240 (July) 1938.

Heat therapy should be of service but Dr. Deakin in the author's clinic studied a number of cases with local diathermy to the penis over long periods of time and even packed the penis and electrodes in clay. There was no appreciable benefit observed. Certainly the urethral insertion of a diathermy electrode is most strenuously to be condemned. It is evident that the extensive circulation of the penis disperses the heat too quickly for any appreciable elevation of tissue temperature. Fever therapy unquestionably would be of tremendous value and has been in many instances in which it has been employed, but there are not enough fever producing apparatus and at present it seems a little heroic to combat in this manner the average anterior urethral infection. Prontosil has been employed with the most astonishing success, anterior urethral infections having been cured within forty-eight hours. This it is hoped is true, but the author has had no experience with this drug.

Treatment of Neurosyphilis. Samuel H. Epstein.

Connecticut S. M. J. **2**:266 (June) 1938.

The various modes of producing artificial fever have occupied the attention of many workers, and much has been done in the construction of apparatus and in the study of its physiologic effects. Experience at the Boston Psychopathic Hospital has been concerned with diathermy, electric blanket, circulating hot moist air (Kettering hypertherm), radiant energy cabinet and the inductotherm, as well as malaria and typhoid vaccine. Some interesting and important physiologic observations were made in connection with mechanically induced hyperpyrexia. The changes during fever so produced were more marked than those which occurred during "natural fever". As a result of studies of the acid-base balance of the blood, blood chemistry and blood volume, it was found that changes in the body are at a minimum when fever is induced by malaria or typhoid vaccine and most marked when circulating hot moist air alone is used. Comparative data made on the percentage of reduction of plasma volume during fever indicate that little or no change occurs during fever induction by malaria, typhoid vaccine and diathermy, while with the hypertherm the reduction is extreme and occurs early in the course of treatment, with the result that a severe degree of tissue dehydration takes place by the time therapeutically desired temperatures have been obtained. Chemical analyses of the blood during the course of the fever were characterized by severe dehydration and hyperventilation, bringing about a pronounced alkalosis, at times approaching a critical level. The conclusion was reached that the degree of dehydration and the danger of serious circulatory disturbance is considerable during fever induced by the hypertherm even when fluids are liberally given by mouth.

Passive Hyperemia — Harpuder and Stein

(*Continued from page 15*)

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(*Discussions of this symposium will appear in an early number.* — ED.)